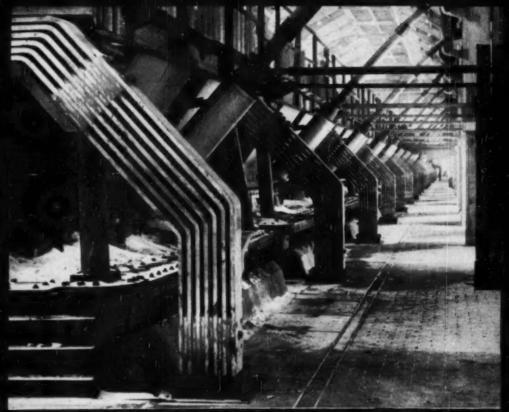
JULY 1950

Chemical & METALLURGICAL ENGINEERING



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Container of tracer liquid going into place. Injector puts measured amounts into pipeline.

Standard Puts the Atom in Overalls

Standard Oil Co. or California has put the atom in overalls and has set it to work in a new products pipeline which is being built from the Salt Lake Refining Co. refinery at Salt Lake City to Pasco, Wash. Company officials consider this one of the first commercial uses of atomic energy in American industry.

The process involves the use of a radioactive "tracer" material in successive shipments of different refinery products through the line in order to notify operators when the last of a consignment of one product has reached any given point in the line, which has been completed as far as Boise, Idaho. Use of this radioactive tracer, the identity of which has not been disclosed, is a Standard Oil Co. of California development, and is believed to have wide potentialities in the transmission of other materials. The tracer was produced in the AEC laboratories at Oak Ridge.

Various methods have been applied to keep track of the movement of successive "slugs" of different refinery products moving through pipelines. The problem involved in operating the new Salt Lake City to Pasco line, however, was particularly tough. The line is long—566 mi. It is designed to carry a number of materially differing products ranging from gasoline to fuel oils, and there are many intermediate stations where portions of some products are removed.

With the new method, each time the pumping station at Salt Lake City changes the product being put into the line, a fraction of an ounce of highly diluted tracer material is injected into the line between the products. As the junction of the two products moves through the line, the tracer moves along with it. At any intermediate point on the line where a product may be drawn off to tank-

age, or at Pasco, electrical instruments utilizing Geiger counters attached to the pipeline respond to the tracer's arrival. An operator therefore knows when one product reaches the cut-off valves, and he then switches the stream of new product into the proper tank.

Tests have proved that use of the tracer involves no hazard whatever in handling using or storing products that have passed through the line. The tracer is not only present in extremely small amounts but also quickly falls off in radioactivity, which eventually disappears altogether.

Helium Producer in Arizona

Kipling Petroleum Co., drilling for oil about 40 mi. cast of Holbrook, Ariz., has encountered natural gas containing an unusually high percentage of helium. Information from the Arizona state land department is that the gas from sands at 775 ft. showed a helium content of 7.3 percent. The same source reported that early last month drilling had reached slightly over 1,000 ft., at which time no analysis of the bottom-hole gas was available.

Thus far there has been no commercial production of helium in Arizona. Large-scale recovery of the gas has been centered in Texas and New Mexico, where the output has been managed and controlled by the federal government. At present there is no prospect, according to sources in the Arizona land department, of an immediate demand for the helium that the well at Holbrook could supply. Last month, Kipling Petroleum planned to continue drilling for oil. Arizona has no significant output of petroleum thus far.

Masonite Builds Second U. S. Plant

Masonite Corp. expects soon to put into operation at Ukiah, Calif., the second wood fiber hardboard plant in the United States. This is the most modern and most highly mechanized such plant owned by the company, which began construction of the first Masonite plant at Laurel, Miss., in 1926. The firm has one plant each in five foreign countries. Capacity at Ukiah is between 400 and 500 units per day of logs.

Ukiah was selected as a plant site because of an adequate supply of Douglas fir and redwood in the vicinity and because of the availability of highway and mil transportation. The company owns a 55,000-acre tract of timber

in Mendicino county, where the plant is situated.

Logs up to 40 ft. long and 60 in. diameter will be hauled to the plant by truck, debarked by a hydraulic debarker and chipped. The chips are fed into evlindrical pressure "guns" 6 ft. long and having internal diameters of 20 in. Steam at 1,200 psi. is then valved into the chembers, where a temperature of 600 deg. F. is developed. After a residence time of less than a minute, pressure is suddenly released, causing an explosive disintegration of the steam-impregnated wood into fibers. The mixture of fibers and steam is then discharged at a velocity of about

2,000 mph, into a cyclone separator. The fiber stock is flowed on a board machine and matted. The cut, felted sheets are then transferred to hydraulic presses, where under a pressure of 2,500 pst., the fiber and liguin are converted to hardboard. No binding material is

Mill effluent (fine fibers and mind) is collected in a classifier, caked on a vacuum filter, flash dried and burned. Soluble matter in wash water from the fiber is concentrated in four single-effect evaporators to about 50 percent solids content, after which the material is burned under boilers which supply heat to the evaporators. Some research on the reclamation of the soluble matter is under way at Laurel.

The Ukiah plant was designed by the company's engineering department under the direction of F. G. Lesniak, who also headed the designing of the plants at Laurel and those abroad.

Plant officials at Ukiah include E. T. F. Wohlenberg, general manager, and Mr. L. mak, chief engineer. Research and development work will be conducted at Laurel.



Dr. Knowles inspects a plot.

Safflower Gets Play in California

As a result of a marked increase this year in California acreage planted to safflower, an oilsced crop long grown abroad, a new oilsced crop for California should be havested this month and during August. This is the first year that the oil will be available in commercial quantities from the state. The California acreage is around 25,000, of which 16,000-20,000 lies in the San Joaquin valley, 4,000 in the Imperial valley, the remainder being in the Sacramento valley. One company estimated in March that there would probably be available about 150 tank cars of the oil, but last month reported that the crop has been damaged somewhat by heavy winds and root rot.

Several seed crushers are interested in safflower as a source of drying oil and high-protein meal. The largest acreage is understood to be under contract to Oil Seed Products Co., Fresno. Pacific Vegetable Oil Corp., San Francisco, is also considerably interested. Other California firms with acreages are Glidden Co., Buena Park, and S. A. Camp Cotton Oil Co., Shafter.

One of these firms declares that "Safflower is more similar to linseed oil than sova in most of its characteristics. The raw oil will air-dry with or without driers comparably with linseed. However, the dried film is somewhat similar to a sova oil film in that it is softer and has similar non-yellowing properties upon aging. These properties follow through also in alkeds made with safflower compared with equivalent oil length linseed products.

with possible exception of very low oil length resins. Cooking schedules in manufacture of most alkyds and obcoresinous products follow the linseed oil procedure more than soya. At the present time a great deal of investigation is being conducted by private concerns interested in the use of safflower as a replacement for linseed and soya oil in their protective coatings, but there is not a great deal of published information in regard to its use in conjunction with other oils or in special products."

Safflower development in California has followd several years of investigation by the University of California agricultural experiment station at Davis, Calif., under P. F. Knowles, who has had the collaboration of University of Nebraska specialists in developing a high-yield variety for the central valleys.

The seed is expected to range between 25 and 37 percent oil content depending on locality and seasonal conditions. Several authorities believe that as a general purpose oil the product will be priced somewhere between linseed and sova oils.

New Gas Supplier Seeks Utah Market

A new company, Utah Natural Gas Co., aiming to provide the Salt Lake valley with large supplies of natural gas for industrial and commercial purposes, has applied to the Utah Public Service Commission for a certificate of public convenience and necessity. The company seeks to construct a 325-mi., \$25-million pipeline from the Four Corners field in southeastern Utah. Since the line would lie wholly with the state, approval of the Federal Power Commission would not be needed.

The Salt Lake City region is already served by Mountain Fuel Supply Co. chiefly from wells in the Church Buttes field of Wyoming. However, despite the drilling of new wells in the field, consumers of natural gas in the area have been feeling the pinch of a tight supply. Utah Natural Gas Co. maintains in its application that present industrial and commercial supplies of gas are inadequate to meet the demand, and that the proposed new pipeline will not be competitive with established distribution

Steel fabrication industries attracted by the Geneva Steel Co. plant at Provo, and smelting and refining firms in the Salt Lake valley, as well as copper fabrication firms that might likewise be attracted to the region, are believed to be potential new users for gas from the Four Corners field if the new 22-in. pipeline project is authorized.

John A. McGuire, of Lowell, Mass., president of the company, says that substantial production and reserves have been established in the San Juan county (Utah) section of the field. A combination of interests has large holdings in the field, including Byrd-Frost Co. of Texas, Paul English of Farmington, N. M., and McGuire, Morgan & Walton of Salt Lake City, and others.

Coast Oil Firm Enlarging Sesame Capacity

Pacific Vegetable Oil Corp., San Francisco manufacturer, exporter and importer of vegetable and marine oils, believes there is a good prospect that sesame will develop as a profitable oilseed crop for regions in the West. The company, which is the largest importer of sesame seed and oil in the country, has been processing sesame since 1930, and is enlarging its capacity by bringing a sesame oil purification plant from Mexico City. The purpose of the plant is to obtain a byproduct, sesamin, which is used in the insecticide industry, as well

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fatty acids.

The Mexico City plant, designed and built by E. A. Hill, production manager for Pacific Vegetable Corp., was operated by Aceitera Carmen Co. Pacific Vegetable Oil is having it dismantled and expects to have it in operation at Richmond, Calif., in the latter part of July. The combined capacity of the unit already at San Francisco and the one being brought from Mexico will be more than double the capacity of the present unit. The company has been obtaining most of its sesame seed from Central America and China.

Company officials point out that the shattering characteristics of sesame in the field has been a serious obstacle to mechanized harvesting and therefore to profitable domestic cultivation. They think there is a prospect that in the next few years a non-shattering variety will be developed through experimental work now under way. The seed has marked advantages by reason of its high oil content (higher than cottonseed, soy and peanuts) which is

exceptionally stable and of light color.



The Basic Magnesium area at Henderson, Nev. Stauffer occupies the property outlined in black.

Stauffer Invites Company at Basic

Stauffer Chemical Co., one of the energetic and growing chemical firms of the West, has conceived an ingenious and unusual idea for getting more business and at the same time minimizing freight charges on Stauffer chemicals made at Henderson, Nev. For five years the company has operated a portion of the huge Basic Magnesium Project, a property administered by the Colorado River Commission for Nevada, and manufactures caustic soda, chlorine, hydrogen, benzene hexachloride, and muriatic acid.

Despite recent newcomers to Henderson there is still plenty of land and equipment available. Accordingly the company hit upon the logical idea of inviting more companies to Henderson who would consume Stauffer chemicals on the spot, and has issued a brochure to chemical consumers and construction firms outlining what Henderson has to offer. Subject matter: chemicals being made there by Stauffer and others, utilities, transportation, labor supply, housing, land and equipment available, and construction companies in the vicinity.

Tussle Develops Over Trans-Northwest

A tussle over how and by whom Canadian natural gas (when that product finally enters the Pacific Northwest) will be distributed to fuel-hungry industries in Washington was developing last month in the state. This occurred as the result of changed and more ambitious plans of the new Washington firm, Trans Northwest Gas Co., Inc., that seeks to distribute Canadian gas to local gas companies.

Originally the firm planned only to construct laterals

(PPI, June) to such companies from a trunk line in Washington that would be owned and operated by the successful corporation among several contenders currently hoping to obtain authority to export gas from Alberta to the racific Northwest. Now, however, Trans-Northwest seeks to obtain what is being interpreted as an exclusive tranchise to build both the trunk line and distribution laterals. A hearing before the state lighway department on the company's application for a tranchise to build both trunk and laterals along highways has been set tentatively for this fall.

Scattle Gas Co. is expected to intervene at the hearing. Gas companies in Washington had not been looking for the emergence of Trans-Northwest between themselves and the Canadian exporter of natural gas.

In an interview at Spokane a few weeks ago, Paul H. Graves, president of Trans-Northwest Gas, assumed the position that an exclusive franchise in what would probably be the major portion of the market outlet for Canadian gas would give his company a strong position in any negotiations with the successful Canadian supplier as to route, capacity and price of the delivered gas, thereby assuring reasonable prices to gas companies in Washington.

Canada Has Own Gas Contest

While the aspirations of Trans-Northwest Gas, Inc. to control the distribution of Canadian gas in Washington are creating a stir in that state, the contest in Canada is considerably wider. Oue angle involves the companies that are striving to win from Parliament and the Petroleum and Natural Gas Conservation board in Alberta, the province where the Canadian gas reserves are centered, the right to build the pipeline from the reserves southwest to British Columbia and the United States.

Among the major contenders (American capital is predominant in each) is Westcoast Transmission Co., Ltd., which has had extensive hearings before the Conservation board. This company plans a trunk line that would run down into British Columbia to Vancouver, with a southern branch extending from near Vancouver down through Washington. Northwest Natural Gas Co. seeks authority to run a line running from Alberta southwest through Idaho and Washington before swinging back up into British Columbia. Prairie Transmission lines would build a line substantially along the route favored by Northwest Natural Gas Co. Hearings before the board in Alberta are expected to extend into this fall.

On the political front, the Canadian government takes the position that no gas can be exported from the country until it is definitely determined that the terms of any export authority will fully protect probable long-term domestic requirements. This is the same position assumed by the Alberta government, whose people, accustomed to using gas at low prices and hopeful that such gas will attract future industries, are pessimistic about the effect on price and reserves of a pipeline carrying large quantities

into the United States.

British Columbia, seeking gas for its own industrial growth at Vancouver and in the interior, has its representatives in the Canadian government supporting a pipeline route that would first pass through the province to Vancouver before any gas is taken into the United States. This route appeals to British Columbia as one which would assure adequate gas supplies to the province regardless of the future volume of demand for gas from the American end. The argument heavily favors the so-called all Canadian route proposed by Westcoast Transmission Co.

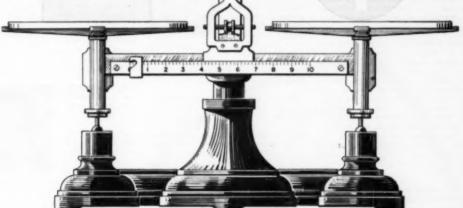
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NAMES IN THE WEST



L. W. Eilertsen

Edward Schuler has been appointed gen-eral sales manager for the Western Dieral sales manager for the vision of Monsanto Chemical Co. He will remain in San Francisco, where he has previously been general sales manager for chemicals and plastics. A native of St. Louis, Schuler joined the company in 1926. Prior to becoming general branch manager of the San Francisco office in 1937 he had been assistant manager of the company's office in New York City. Leo Eilertsen, previously general sales manager of adhesives and special prodnets, has become assistant to the general manager of the Western Division. He joined I. F. Laucks, Inc., predecessor of the division, in 1919, and became vice president in 1944 when Monsanto bought the firm. He was elected president of the Association of Washington Industries this year.

Donald J. Miller has been appointed manager of Monsanto Chemical Co.'s new polystyrene molding compound plant at Long Beach, Calif. A native of Texas, and chemical engineering graduate of Washington University in 1941, he joined the company in that year at the Spring-field, Mass., plant. Until the change he was laboratory supervisor at Springfield At the same time, Joseph R. McCleskey, Ir., has become plant supervisor at Long Beach. He was previously a supervisor at Springfield, and is a chemical engineering graduate of Alabama Polytechnic Insti tute (1942).

K. H. Crandall havbeen elected a vice president of Stand ard Oil Co. of Cala fornia. Since 1947 he has been vice chairman of the board of the California Co., a Standard subsidiary operating in the Rocky Mountains



K. H. Cranda?

and the Central and Gulf Coast regions. He has been director of another subsidiary, Standard Oil Co. of Texas, since 1948. He joined the California Co. in 1925, and became a director and vice president in 1942, then president in 1945. He is a graduate of Stanford University.

Richard E. Hoagland has become vice president and assistant general manager of Utah Fuel Co., subsidiary of Kaiser Steel Corp. Prior to his appointment he

was manager of byproduct sales for Kaiser with headquarters in Los Angeles. He has been transferred to headquarters of Utah Fuel Co. in Salt Lake City

president of Cutter Laboratorics, Berk-ciey, Calif., has become president of United Employers, Inc., an organizarepresenting tion over 1,000 firms in Alameda and Contra Costa counties in management-la-



F. A. Cutter

bor relations. For several years he has served as vice president and member of the board of the organization. Cutter's firm is a manufacturer of penicillin and other biologicals at Berkeley.

C. Harry Snell has become district manager of Celanese Corp. for the western sales area, with offices in San Francisco. He is in charge of sales of industrial organic chemicals that the company manufactures at Bishop,



C. H. Smill

Tex. Snell was previously western representative for the company. He is a graduate chemist from Hope College in Michigan.

Charles A. Priode has become administrative assistant to Charles N. Gross, manager of the manufacturing divisions at Hanford Works, Richland, Wash. Priode came to Hanford this year as staff assistant of the divisions. Previously he was assistand superintendent of Polythene production at the Sabine River works (Orange, Tex.) of the Du Pont organization. He was with Du Pont 12 years. A native of West Vitginia, he holds a science degree from Ohio University.

J. B. Sutherland has been temporarily relieved of his duties as Los Angeles division manager of Ohio Oil Co. because of ill R. M. Miller, division superintendent, is handling Sutherland's work for the time being.

Alexander MacGilivray has been elected a vice president of Gladding, Mc-Bean & Co., large manufacturer of diversified ceramic products. MacGilevray, who joined the company in 1040, will direct the administration of accounting and



A. MacGillivras

financial matters, budgets and market reseatch, with headquarters at Los Angeles.

Gordon Schumacher, former assistant district manager in Los Angeles for Hagen Corp. and its affiliates Calgon, Inc., Hall Laboratories, Inc., and Buromin Co., has been made manager. He suc-ceeds R. L. Sullivan, who has re-



G. Schumacher

signed to form his own firm. Schumacher joined Hagen in 1942. Prior to that he was employed by Consolidated Western Steel Corp. He is a chemical and petrolenm engineer. Assisting him is Joseph R. Shafer, who joined the firm in 1941 in an engineering capacity.

David F. Shaw has been made manager of Hanford Operations at Richland, Wash., suc-ceeding Fred C. Schlemmer, who resigned to enter private industry. Shaw has been assistant manager and deputy manager for the last three years.



He is an engineering graduate of Georgia School of Technology. After graduation in 1934 he worked with Tennessee Valley Authority in building three major dams After World War 2 service he was assigned to the Manhattan Engineering District for atomic bomb work. He came to Richland in 1947.

John D. Fredericks has been elected president of Pacific Clay Products Co. at Los Angeles, replacing the late Roy Lacy. Freder-icks has been with the company for 25 years in the capacities of attorney, assistant secretary. general counsel and,



J. D. Fredericks

more recently, vice president. He is the son of the late John D. Fredericks, Sr., who was a former president of the firm, manufacturer of ceramic pipe, glazed floor and wall tile and architectural terra cotta products in plants at the California localities of Los Angeles, Los Nictos, Stockton and Alameda.

Milton R. Beychok has become chemist for Rothschild Oil Co., which operates a petroleum refinery at Santa Fe Springs,

E. L. Foreman has been appointed director of research for S. M. Pharmaceuticals Division of Special Milk Products, Inc., at Los Angeles, where he has assumed charge of laboratories and development of new products.

M. W. Kibre, assistant manager of Genetal l'etroleum Corp's gas department since 1945, has become manager, replacing H. L. Eggleston, resigned.

J. O. Julson has succeeded Marvin C. Jones as manager of the Weyerhaeuser Timber Co. container board plant at Springfield, One.

Rodolfo Hernandez
Corso has been
selected as the first
international research fellow of
Stanford Research
Institute, Stanford,
Calif. His appointment for a two-year
term at Stanford
was made by Carlos Novoa, director
general of Bank of



R. H. Corzo

Mexico. The apparatree holds degrees in chemistry and bact riology from the National School of Biological Sciences in Mexico, which he has directed since 1945, and which post he retains. He obtained a master of science degree from Northwestern University in 1940.

Vance N. Jenkins, research supervisor of Union Oil Co. of California, was elected president of National Association of Corrosion Engineers at the annual meeting this year.

D. W. Pearce has become assistant to A. B. Greninger, manager of technical divisions at Hanford Works, Richland, Wash. Among his duties will be liaison with the technical activities of other atomic energy sites. It was announced last month that F, W. Albungh would be transferred to the technical services division as assistant division head, and will be in charge of the analytical section, which Dr. Pearce formerly headed. F. J. Leitz was scheduled to become assistant chief of the chemical research section.

E. T. F. Wohlenberg, general manager of the new Masonite Corp. hardboard plant at Ukiah, Calif., has been elected chairman of the California Redwood Council, an organization that has been formed by members of forest industries in the redwood region.

R. C. Clark, manager of the refinery of Utah Oil Refining Co. at Salt Lake City, has become a director of the company. Clark, an engineering graduate of Cornell, replaces M. J. Greenwood, who asked to reture from the board.

FIRMS IN THE WEST

Bechtel Corp., San Francisco, has announced that Arabian Bechtel Co. has obtained a contract from Iraq Petroleum Co. for construction of a 556 mi pipeline running from the Kirkuk oil field in Iraq to the Syrian coast of the Mediterranean. Capacity will be about 300,000 bbl. per day.

Douglas Fir Plywood Association has elected Frost Snyder, president of Van-couver Plywood Co., president. Other association officials named are Victor Olson, president of Washington Veneer Co., vice president; Charles M. Duccy, treasurer and general manager of Menasha Plywood Corp., secretary.

Standard Oil Co. of California will distribute 16 graduate fellowships, with a total value of \$23,000, among 11 universities for the academic year 1950-1951. The schools and the fellowships involved ate:
University of California, mechanical engineering and paleontology; University of California at Los Angeles, chemistry and mechanical engineering; Stanford University, mechanical engineering and geology; California Institute of Technology, chemical engineering, physics and geology, Oregon State College, mechanical engineering; University of Washington, chemical engineering; University of Illinois, chemistry, University of Wiscousin, chemical engineering; University of Michigan, chemical engineering; University of Michigan, chemical engineering; Harvard University, chemistry,

Richfield Oil Corp. has completed in the Cuyama valley oil field in California a second natural gasoline recovery plant with a gas processing capacity of 30 million ft. per day. Natural gasoline, propane and

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butane are the products recovered. The company put a plant of similar capacity into operation last fall.

S. Paul Ward, Inc., manufacturer of ceramic glazes and distributor of ceramic supplies at Los Angeles, is creeting a new building to enlarge storage space and shipping facilities.

National Cylinder Gus Co. has arranged with Iceco Corp., manufacturer of dry ice in northeastern New Mexico, to distribute a portion of Iceco's product along the California coast, Texas and adjoining localities. The dry ice is produced from carbon dioxide wells in New Mexico with a daily productive capacity of up to 100

Union Oil Co. has acquired United Geophysical Co., which is headed by Herbert Hoover, Jr., and has announced that no changes will be made in the management of the latter firm, which will continue to maintain its offices at Los Angeles.

The Stuart Co. plans construction of a research laboratory for pharmaceuticals at Los Angeles. The building to be creeted will house the laboratory and the Chicago firm's Western Division offices. ment involved is about \$400,000.

Imperial Oil Co., Ltd., has completed a new casinghead gasoline plant at Leduc, A'ta, with an initial capacity to process 1" million ft. of gas per day and a planned ultimate capacity of 24 million ft. The plant was built to recover gasoline components from oil wells in the Leduc-Woodbend field.

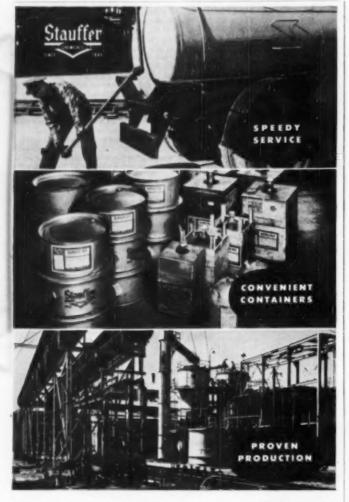
Natural Gas Equipment Co. has acquired representation in California, Oregon, Washington and Arizona for products of Valve and Primer Corp. of Chicago and has obtained a new office building and warehouse at Pasadena, Calif. The firm is also western representative for Surface Combustion Corp. and other manufacturers of fuel equipment.

United States Gasket Co., Camden, N. J., has appointed W. S. Shamban & Co., Los Angeles, exclusive representative for California

Cal Dri Ice Co. is producing dry ice from a new carbon dioxide well at the company's plant near Hopland, Calif. duction from the new 790-ft. well has increased capacity of the plant to 21,600 lb. of dry ice per day.

Shell Development Co. has made extensive organization shifts in research and development activities at Emeryville, Named associate directors of development are B. M. Beins, mechanical engineering; M. Souders, Jr., chemical engineering; C. L. Raymond, process engineering; and D. L. Yabroff, process development. Other appointments include C. R. Nelson as head of process engineering; G. E. Lindholm and A. J. Cherniav sky assistant heads; G. A. Nelson as staff metallurgist; W. E. Hand as head of costing and appraisals; P. D. Hishon as chief draftsman in development; and P. R. Hoyt and M. V. Long as staff con-sultants on instrumentation. D. J. Pompeo is head of a new department that centralizes the instrument research and development groups. T. W. Evans is director of the research division. A. J. Johnson, vice president and director of development, is in charge of the development division. H. E. Randlett, Jr., became administrative assistant to the director of research.

Matthews & Dennin is a new partnership established in San Francisco in the Matson Bldg, to distribute paint ingredients and industrial chemicals. Ransdell Matthews and John W. Dennin were previously partners in S. L. Abbot Co. at San Francisco before they relinquished their interests. They will cover territory between Bakersfield, Calif., and Oregon.



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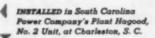
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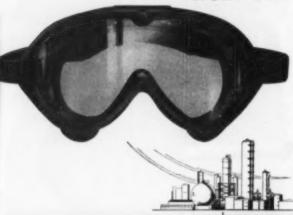


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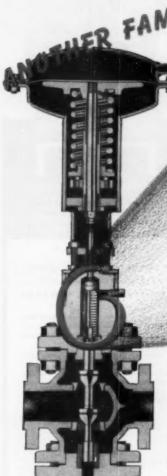
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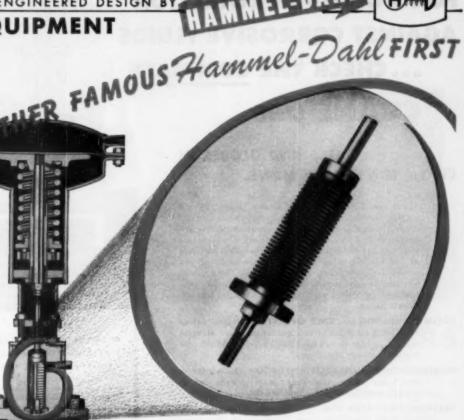
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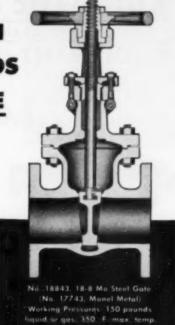
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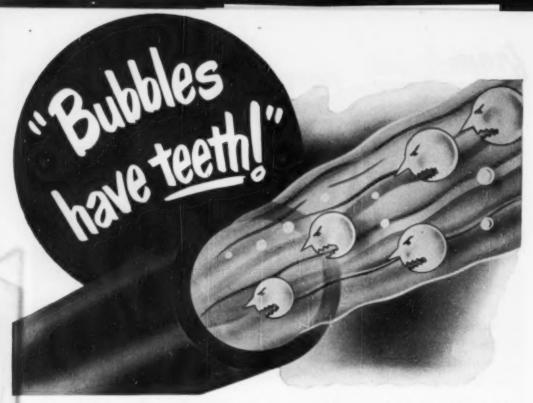
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Thus it happens that every once in a while the Research Department in Rome, New York, working through the Technical Advisory Service, is able to say that there is air leaking into a condenser it has never seen, in a far-off state. The problem then is to seal the water system against the entrance of air. This is not always an easy task, and it is one that the Revere Technical Advisory Service is glid to tackle together with the customer if asked to do so. After all, we want our condenser tubes to last as long as possible; that's what makes customers happy, and builds and preserves our reputation as producers of fine tubes.

In one such instance of bubble trouble, the operator, a public utility, could find no visible sign of a leak. Checking and tightening every bolt and seal produced no results. Finally it was decided to put plate glass windows in some of the inspection plates, in order to see what was going on inside. This located the defect, a stream of bubbles being easily seen pouring out of a gasket. The water was flowing past that gasket with sufficient velocity to suck air in.

In another instance, a few samples of failed tubes from an oil refinery (located almost 3,000 miles away from the utility) were sent to Revere's Research Department. The refiner was told that his trouble was due to bubbles. Again, a check of the condenser showed nothing. The water inlet and outlet lines and all gaskets and bolts seemed to be perfectly tight. Here was another puzzler. But once again it seemed plausible to assume that air was being drawn in where water velocity was high enough to create a suction. The search finally went all the way back to the water pumping station, where two cracked castings were located. Air sucked in through two tiny cracks was enough to do a lot of damage; bubbles do indeed have teeth.

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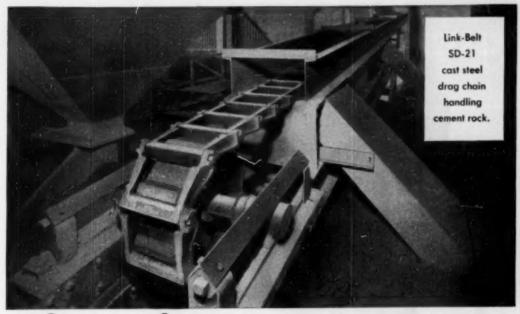
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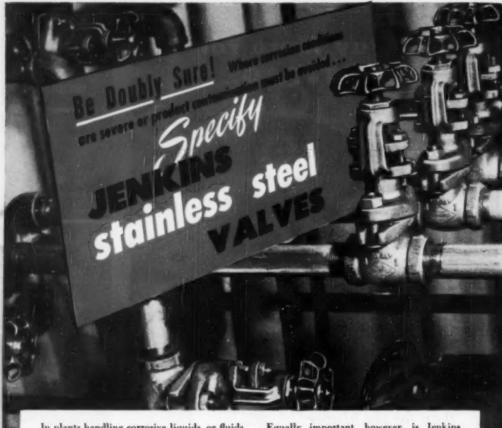
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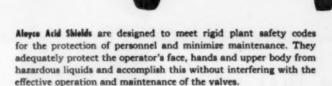
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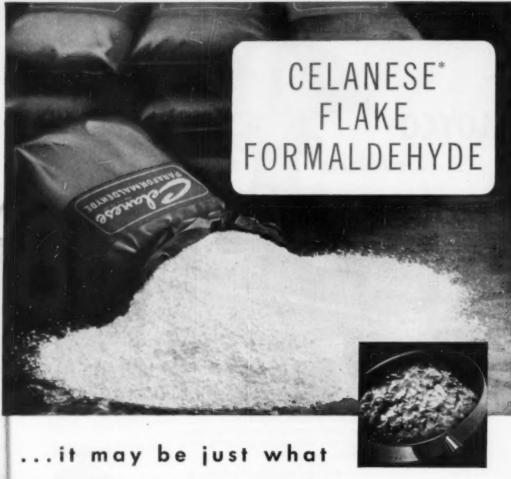
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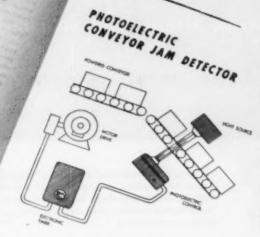
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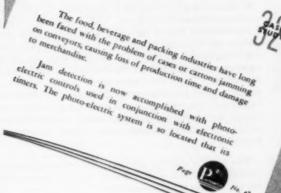




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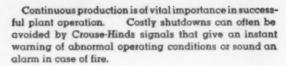
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surroundings where a constant hum or whine is present but a bell could readily be heard. A bell would be inadequate in surroundings where the noise is produced by hammering on metal but a horn would give the required contrast.

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2 • Mercury level not critical.

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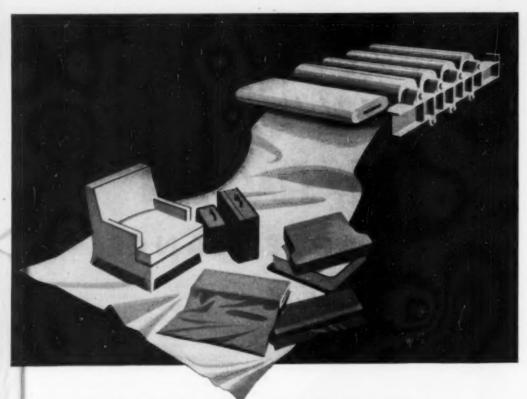
Adjustable over a 7 to 1 range of differentials.

For full information on these meters, or on any application in which you are interested, write to Hagan Corporation, Hagan Building, Pittsburgh 30, Pa.



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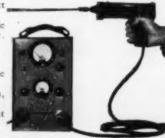
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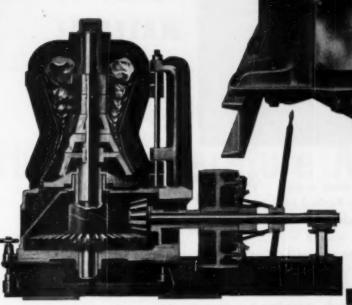


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These rugged crushers speed output of fines, cut reduction costs. Desired fineness is quickly obtained by regulating hand wheel. "Open-door" accessibility permits fast, easy cleaning. They crush fine . . . crush fast and do not clog. Available in output capacities from 1 to 30 tons-per-hour. Write for catalog.

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Designed to handle High Temperature Materials

Here's A New Low-Head gyratory sifter for the chemical industry. It's the Allis-Chalmers all-metal sifter — patterned after the Low-Head standard gyratory sifter — but new and different because it's made entirely of metal!

High temperature materials can be sifted in this machine since there are no wooden parts to be affected. And cleaning is a simple matter. It can be easily and safely washed.

Numerous materials — ranging from pure chemical products such as barium nitrate to impure metallurgical products such as zinc concentrate — can be efficiently handled by this all-metal sifter.

Compactly constructed of steel and magnesium, the Low-Head all-metal gyratory sifter is a high speed, high capacity machine holding four to seven sieves. Sieve screens can be silk or metal, with a variety of mesh to choose from.

The all-metal sifter is available now! Send coupon for details.

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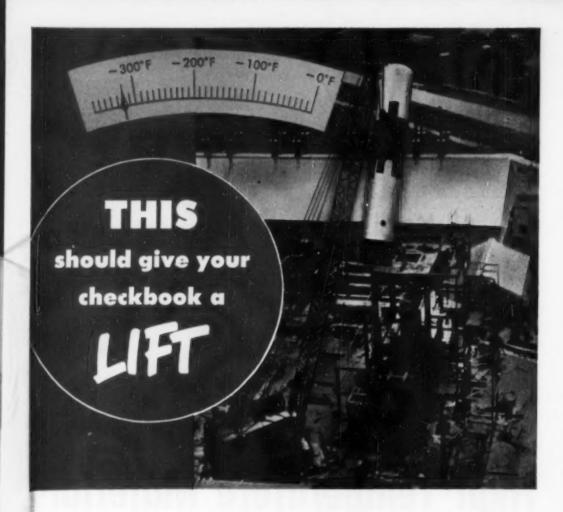
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Ordinarily it would take two cranes to lift this oxygen plant bubble cap tower into position. But this is no ordinary tower. Made of Alcoa Aluminum, it weighs half as much as towers of heavy metals...handles far easier in fabrication, shipment and installation.

Also Alcoa Aluminum gets stronger and tougher as temperatures drop. It costs 25 to 50% less than other materials suitable for sub-zero processing.

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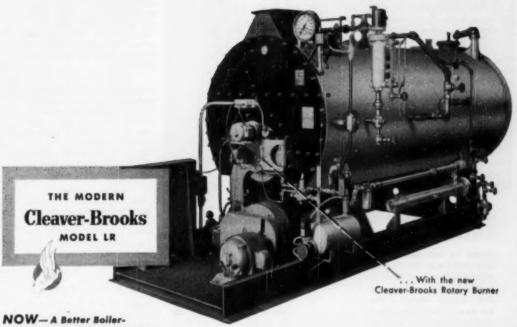
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Burner Unit to Utilize Today's
Low-Cost Fuels — Heavy Oil and Gas

The Cleaver-Brooks Model LR is a "trailblazer" in modern self-contained boiler design and construction. It makes more effective use of today's low-cost fuels, (heavy oils and gas), and you are assured of better boiler performance.

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 simple — compact — precision machined — perfect mechanical balance —
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 single low-speed, low-power consumption blower furnishes both primary and secondary air for combustion—less weight and space requirements — reduction in sound levels.

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 — electronic combustion safety devices, dual low water cutoffs — are standard equipment.

simplified design of combination gasoil burner permits change-over from oil to gas or vice versa in less than a minute.
 improved design of boiler furnace and liberal heating surfaces provide greatest economy with all fuels.

— boilers of all-welded construction meet standards of A.S.M.E. boiler code and leading underwriters — burner approved by recognized national agencies.

The Cleaver-Brooks Model LR selfcontained boilers are of a highly developed four-pass fire tube design — tested and proved by factory and field experience on several thousand boilers of this type, Write for complete specifications, dimension data, firing rates.

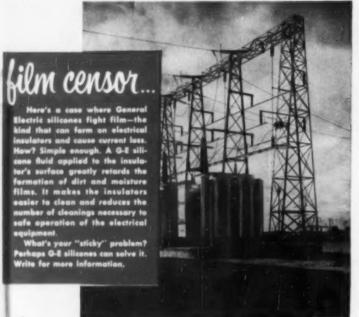
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News of developments from General Electric's Chemical Department that can be important to your business.



When the squeeze is on

depend on G-E plastics! This juice bowl for an electric mixer was molded by General Electric. G-E designers, working with G-E chemists, selected a plastics material that made possible cost reductions plus two new sales features: the bowl is practically unbreakable—and a new "agitating" principle more effectively strains juice. Another plus for plastics!



Fit for a king!

"Regent," the sensational G-E Textolite* pattern, is the latest of the General Electric line of resin-impregnated laminated surfacing materials. (G-E makes many of its own resins.) This new design has an intriguing three-dimensional look. It is available in five sparkling colors for surfacing kitchen cabinets, dinette tables, restaurant tables, and other applications.



Molders are producing plastics parts with amazing shock resistance—thanks to General Electric's new rubber-phenolic compounds. There's a whole family of these compounds to choose from, with different fillers to give specific properties.

Motor repair shops are simplifying rewinding operations by stocking General Electric's "all-purpose" insulating varnish G-E 9574. Suitable for practically all types of insulating applications, this varnish is easy to use and providea exceptional chemical and mechanical resistance.

Paint manufacturers are obtaining tough, durable lacquers for both wood and metal finishes by formulating with G-E 2477 Glyptal.* This top-quality plasticizing alkyd reain provides outstanding resistance to cold checking.

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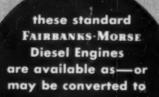
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MODEL 38 Opposed-Piston Engine: 640 to 1920 horsepower at 720 r.p.m. If you are situated where natural gas is or soon will be available, don't fail to investigate the savings possible through installing Fairbanks-Morse Dual-Fuel engines — or converting your present Fairbanks-Morse equipment to Dual-Fuel operation. The economies in running on low-cost natural gas or diesel fuel are easy to estimate — and surprisingly high! Today Fairbanks-Morse is the largest supplier of dual-fuel engines — over a hundred plants are cutting the cost of fuel to new rock bottom lows. To figure how much

you can save, send for the charts shown below — or call your Fairbanks-Morse diesel specialist.

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Cherts that show you exactly the savings you can make in fuel cost by using Fairbanks-Morse Dual-Fuel engines are available. Ask your Fairbanks-Morse diesel specialist or write the nearest branch office.

This MODEL 33 Fairbanks-Morse Engine was converted to Duel-Fuel In the field at lew cost. Sizes to 2,000 horsepower.

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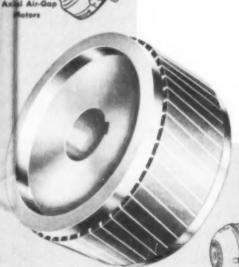
the "One Call" Electric Motor Store that sells Service

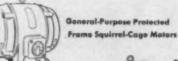
In your Fairbanks-Morse branch you have a single source for all your motor and generator requirements. There you can get advice and service that are not limited by restrictions in available sizes and types—that are underwritten by the broadest contact with motor applications like yours. Hundreds of plants are fully equipped with motors bearing the Fairbanks-Morse name—including everything from fractional ratings—through standard and specialized types of all sizes—up to and including large generating equipment. Why not have this experience working for you? Write or call the nearest sales center listed below.

EXCLUSIVE Copperspun Rotor

IS INDESTRUCTIBLE . . .

Identifying all Fairbanks-Morse motors in the more popular ratings, the Copperspun Rotor is a prime reason for their reputation for long-run sturdiness with little maintenance expense. Truly indestructible, the rotor is centrifugally cast and, with its well proportioned shaft, dynamically balanced to insure smooth and quiet operation. This exclusive Fairbanks-Morse feature is another reason why you should visit or write your nearest Fairbanks-Morse sales center to get the whole story on the motors which interest you.







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FAIRBANKS-MORSE

Newest Pump is up to 25 times as "Non-Clog" as conventional types!

One of the latest Fairbanks-Morse achievements in hydraulic engineering, this truly non-clog pump makes possible amazing efficiency in pumping water containing solids and/or trashy material such as industrial waste, sewage—even such things as fish, fruit, etc. Its advanced hydraulic characteristics permit the use of smaller driving motors, and it is interchangeable with Fairbanks-Morse pumps of corresponding size in existing installations. Proved in two years of actual service, this Fairbanks-Morse non-clog pump promises solutions to industrial pumping problems heretofore thought to be impossible. For full details write or call your Fairbanks-Morse sales center.

A pump for every purpose in the FAIRBANKS MORSE line here are a few...

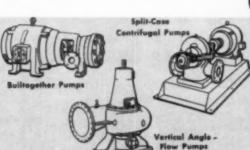
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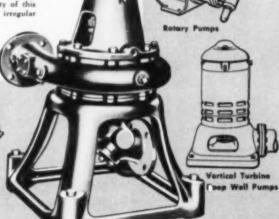
AMAZING NEW



The impeller of this pump is a single helical channel—a "whirling tube"—there are no blades, no restrictions to the free passage of fibrous trash. Observers have been amazed at the ability of this impeller to pump consistently stringy, irregular trashy materials.

Fairbanks-Morse Non-Clog Pump -2-inch to 5-inch sizes with wide range of capacities.





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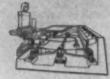
.. and so can losses, too! If weighing operations throughout your plant are less than absolutely accurate, the way is open to inefficiencies and losses, hard to discover, tough on the cost sheet. That's why it's a good idea to call on a Fairbanks-Morse weighing specialist: let him scan closely every weighing and bulk measurement function in your plant with an eye toward eliminating sources of inaccuracy, speeding up weighing services and breaking weighing "bottlenecks" wherever they're found. Remember, he is backed by over 100 years of scale research and development - and has the most complete line of industrial scales to use in solving your specialized problems.

For every weighing operation there is a famous FAIRBANKS-MORSE

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FOR THE RECORD ... WEIGH WITH - Printomatic

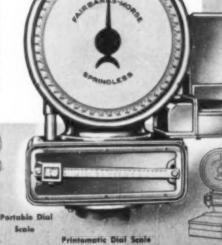
Load the scale . . . prem the button . . . and recrive the correct weight printed on a ticket. This is the modern method of weighing developed by Fairbanks-Morse in the Printomatic weigher, one of the most modern, most versatile scales on the market-ideal for batching operations, weighing of liquids, food products, grain, dairy products, coal, steel, component parts, finished products, etc. Thousands in daily use! To know more about Printomatic, ask your Fairbanks-Morse sales specialist.



Motor Truck Scale



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NO. 8

JULY, 1950

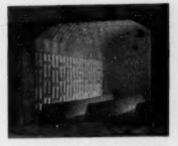
Are Super Refractories Limited to High Temperature Applications?

High temperature resistance is an inherent characteristic of super refractories by CARBORUNDUM. However, there are other properties which may be equally important reasons for selecting such refractories — for low as well as high temperature work.

The heat flow rate of CARBOFRAX silicon carbide refractories, for example, is practically the same (for the same temperature difference) at low temperatures as it is at high. Likewise, such properties as chemical stability, hot strength, wear resistance, and heat shock resistance are equally effective in low temperature jobs. Consequently,

refractoriness as such, often becomes a secondary reason for picking a super refractory, even where elevated temperatures are involved.

Lowered fuel costs, more production, and appreciably reduced maintenance expenses are all demonstrated benefits of these super refractories that have been realized for reasons aside from high temperature resistance. And although other refractories may be considered adequate from a life standpoint in many low temperature jobs, there is every probability that substantial savings can be effected by proper use of super refractories by CARBORUNDUM.



Muffle Performance Tells the Story

This photograph shows an ALFRAX electrically fused aluminum oxide muffle after six years in a porcelain enameling furnace. For four years, the furnace operated continuously on sheet steel and cast iron stove part production. Then, it was turned to stress-relieving work on heavy armor parts at a temperature of 1295° F. Loads of armor averaged 450 lbs. — were left in the furnace four hours. There were three loads a day, and during each change the temperature was dropped to 800° F. and then returned to its operating temperature.

After six years of this rigorous but relatively low temperature service, the only thing needed in this furnace was a new bottom! The low thermal expansion, chemical inertness and high cracking resistance of the ALFRAX tile kept the side walls and arch in first class condition — and without maintenance. Furthermore, high strength permitted use of thinner tile — aiding heat transfer through the muffle — and assisting fuel economy. Similar advantages are possible in other installations, involving either high or low temperatures.



Uniform Heat Flow Required Here

Used over a varnish fire, this dome provides a soft, even radiant heat. This results from the high thermal conductivity of the CARBOFRAX silicon carbide material. Its use facilitates the "cooking" operation — extends keetle life, Resisting repeated heating and cooling, the CARBOFRAX dome gives longer service and reduces repair bills.

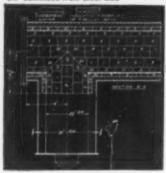
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SPACE INC.	-	High .	High	Good	Good	Good
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THERMAL EXPANSION (25" — 1400" C.)	.0000044	.0000059	.0000067	.0000074	.0000084	.000008
HOBOLUS OF BUPTURE @ 2445" F. PSI	800-3125	100-250	175-475	100-1050	100-225	30-100
WEIGHT 9 IN. STRAIGHT	9.25 lbs.	9 lbs.	1 h.	10.1 fbs.	7.25 Ba.	48.84

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Address all correspondence to: Dept. H-70, THE CARBORUNDUM COMPANY, Refractories Division, Perth Amboy, New Jersey

Continued on other side ---



Hot Spots Eliminated in Flue Connector Linings

In the flue connecting a water-gas generator with its carburetor temperatures are relatively low. However, fireclay linings often erode in limited areas because of scurfing by the coke particles. Hot spots develop and production must be interrupted for repairs.

i Since they are exceptionally resistant to crossion at both high and low temperatures, CARBOFRAX silition carbide the are ideally suited for this application. They retain their original thickness much longer, even at tees, ells and sweeps, where punishment is most severe. Also, the hard, dense CARBOFRAX the resist carbon penetration and builden. Elimination of expensive shutcowns, and of repeated repairs, quickly mays back the initial investment.

This is another example of where other specialized properties of CARBO-GRAX brick and tile are more important than refractoriness.

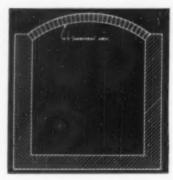


Abrasion, the Main Problem Here

Abrasion used to be the principal problem of this furnace. Operated at temperatures under 2000 F, the floor was worn away when aluminum-bronze castings weighing up to 700 lbs were dragged across it. The resultant unevenness of the hearth caused the castings to sag during heat treatment.

The problem has now been eliminated by using CARBOFRAX silicon carbide tile with their high abrasion resistance. The floor remains level, and distortion of castings avoided. Furthermore the hearth is still in operation after more than three years — a life figure that compares with about one a year for other types of hearths.

The high thermal conductivity of CARBOFRAX tile — another property equally useful at low temperatures — has also resulted in other improvements. First, more uniform and rapid heat delivery to the work chamber gives an improved heat treatment. Secondly, fuel consumption has been reduced. And, finally, the furnace can now be operated faster due to a quicker temperature come-back after being charged.



Super Refractory Picked for High Thermal Conductivity

This sulphur burner combustion chamber—shown in cross-section—is an interesting application of a CARBORUNDUM super refractory for a relatively low temperature job. The high thermal conductivity of CARBOFRAX silicon carbide brick is used to excellent advantage in the arch. Principally because of this feature it is possible to operate the onit at exceptional ratings and still maintain required temperatures of gases entering the Glover tower.

When a standard 9" thick fireclay arch is used in a burner of this type, approximately 1000 BTU's per hr. and sq. ft. are dissiputed. A CARBOFRAX arch, however, dissipates approximately 1000 BTU's per hr. and sq. ft. This is due to the high thermal conductivity of the CARBOFRAX brick, and also because of the fact that their great mechanical strength makes possible an arch only 41," thick. As a result, an extra ton of sulphur is burned each 24 hrs. per 24 sq. ft. of CARBOFRAX arch. Moreover, because of their low thermal expansion, inertness to furnace gases and absence of spalling and cracking, CARBOFRAX arches like this one are still in use after 18 years of continuous service,



Here Again, Refractoriness of Secondary Importance

In this gas-fired artware kiln, the high thermal conductivity of the CARBOFRAX silicon carbide muffle comes into play. It permits more rapid and uniform heat delivery to the ceramic ware — with a consequent improvement in ware quality and a decrease in the number of rejected pieces. Moreover, it is unnecessary to maintain as high a temperature in the combustion chamber to secure the requisite heat in the working chamber — which means longer life for the other refractories — and lower fuel costs.

Other characteristics of CARBOFRAX tile important here are: High strength, which permits using thinner tile to further aid heat transfer; and high resistance to spalling and cracking which means long life in spite of repeated heating and cooling.

To obtain facts and figures on installations in specific fields merely select from this list of bulletins. Copies will be sent you at once. No obligation, of course.

Super Refractories by CARBORUNDUM (general catalog)

Super Refractories for the Ceramic Industry

Super Refractories for the Process Industry

Super Refractories for Boiler Furnaces
Super Refractories for
Heat Treatment Furnaces

Super Refractories for Gas Generators
The Fraz Line of Cements
CARBOFRAX Refractory Skid Rolls

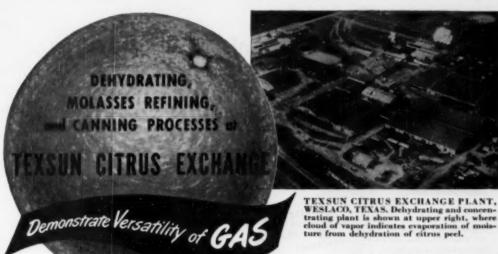
Porous Media for Filtration & Diffusion

Dept. No. H-70

THE CARBORUNDUM COMPANY

Refractories Division

PERTH AMBOY, NEW JERSEY



CITRUS BY-PRODUCTS processing is a large part of the operations of Texsun Citrus Exchange, Weslaco, Texas. One of the world's largest processors and canners of citrus, Texsun not only packs juices and edible fruit but processes the residue

into citrus molasses and citrus pulp used in stock feeds.

Although Gas is used for all Texsun beating operations, its major role is in the dehydration and refining process. The rotary kiln method, which consists of eight 90' kilns with

a total capacity of 40 tons of raw products per hour, is the dehydration process which completely dries the pulp and peel.

A unique method developed by Texsun, to purify and retard fer-mentation of their citrus molasses products, is to inject natural gas and air directly into the liquid, igniting it and causing it to heat as it bubbles to the surface.

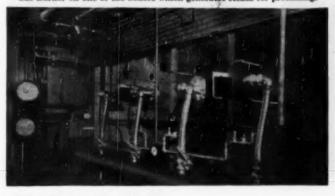
Sid Rankin, Supt. of Dehydration at Texsun emphasizes the importance of retaining color and vitamin value in the finished product, which requires heat-processing at precise temperatures just below the boiling point. Mr. Kankin states—"We could not turn out a product of such high quality without the use of natural gas as it is readily controlled and is very economical. In our patented process in the manufac-turing of citrus molasses, natural gas is indispensable."

Texsun has used GAS for heatprocessing since the Weslaco plant was built in 1936. These applications of GAS represent some of the important ways in which GAS serves the food industry. Ask your Gas Company Representative about other heat-processing applications in your

business.



Gas Burner on one of the boilers which generates steam for processing.



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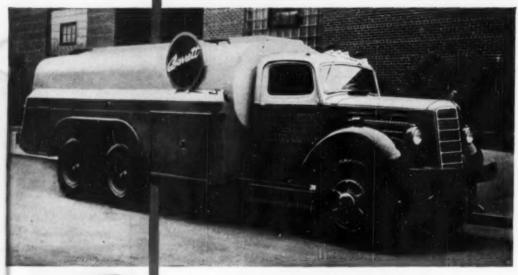
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The four 48" SK Fume Scrubbers in the top view are used for absorption of sulphurous fumes in on all refinery.

The two 6" SK Fume Scrubbers In the lower photo are made of Haveg and handle hydrochloric acid vapors at the plant of a large producer of synthetic materials.

BNOXIOUS, contaminating fumes and vapors-heavy, corrosive and dangerous dusts-need not create a major plant problem, can be effectively and economically controlled.

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If your conditions are such that fumes or dust can be knocked down and scrubbed with water or other liquid, an SK Fume Scrubber can do the job economically. Simple in construction, these units produce their own draft and give complete mixing without possibility of by-pass.

Standard and Special Fume Scrubbers are available in various materials such as cast iron, welded steel plate, Haveg, stoneware, hard lead and other corrosion resistant alloys or chemical resistant linings. Rubber lining is available with cast iron or welded steel plate.

For complete information, write for Bulletin 4-R. If your problem is immediate, call or teletype.



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SANTICIZER 141 MAKES VINYL FILMS SAFE FOR PACKAGING VARIOUS FOODS



Acceptance of Santicizer* 141 by the Meat Inspection Division of the Bureau of Animal Industry, U. S. Department of Agriculture, as a nontoxic plasticizer for use in plastic products which may come in contact with meat, opens the way for the production of vinyl films that will bring improved packaging to margarine, meat, cheese, cranberries and numerous other food products.

In addition, the approval is assurance of the nontoxicity of Santiciser 141 in any application where such quality is desirable. Other qualities delivered by Santiciser 141 include: 1. Flame resistance. 2. Softness and drape. 3. Resistance to weather. 4. Low-temperature flexibility. 5. Light stability. 6. Low volatility. 7. Resistance to embrittlement. 8. Strength, clasticity and abrasion resistance. In many cases, Santiciser 141 improves processing.

Emulsifiers step up efficiency of sprays

Insecticides, fungicides and herbicides can be used more efficiently, with economy and a minimum of effort, through the use of Monsanto emulsifiers and wetting agents.

Most toxicants used in formulations of herbicides, insecticides and mothicides cannot be dissolved in water. The practice is to concentrate these toxicants in oil or an organic solvent and to use relatively small amounts of the formulations in water for spraying. Adding Monsanto emulsifiers and wetting agents to the formulations results in excellent emulsions that spread more evenly and have better adherence. If you are a formulator, mail the coupon for a free copy of Technical Bulletin No. P-142.



Research Chemists' Corner

You may find samething new here

If you are interested in new chemical discoveries, have a look at the specifications of Methyl-para-Toluenesulfonate. The specifications may suggest research that will lead you to the development of a new chemical product... or the improvement of an existing product. If you want further information or a sample, mail the coupon.

Mothyl-para-Toluenesulfonate

Structural Formula:

Malacular Weight: 186.22

Crystallizing Point: Approx. 25° C.
Calor: Approx. 100 APHA

Chlorino: 0.01% Max.
Acidity as TSA: 0.01% Max.
Seponification Value 186.0 — 187.5
Sp. Gr. et 28/35° C. 1.225 — 1.227
(super-cooled figuid)

Suggested Uses: Dye intermediate, alkylating agent, cotalyst for alkyd and other organic ester preparations, photographic chemicals, and pharmaceutical intermediate.

Santomerse No. 1, all-purpose detergent and wetting agent, available in three densities

Extensively used as an ingredient in industrial cleaning compounds and as a wetting agent and surface-active agent, Monsanto Santomerse 8 No. 1 now is available in three densities. These include a granular Santomerse No. 1, designed especially for easy mechanical blending.

Santomerse No. 1, which contains a minimum of 40% active material, does a thorough job of cleaning. It lifts out particles of grease and grime and holds them in suspension so that they cannot be redeposited. Santomerse No. 1 rinses out easily and thoroughly. It is effective in hard or soft, hot or cold water and in acid, neutral or alkaline solutions. It has been found effective in temperatures ranging from below zero to above the boiling point.

For additional information on Santomerse No. 1, mail the coupon or contact the nearest Monsanto Sales Office.

HB-40 cuts plasticizer cost in clear vinyl film

Monanto HB-40 (partially hydrogenated terphenyl) is practically water-white, making it attractive for plasticizing vinyl films that are transparent or which are to be brilliantly colored. Since HB-40 is extremely low in cost and since it can replace substantial amounts of the primary plasticizer, it can be used to reduce production costs. This savings in costs can be attained without a reduction in quality.

HB-40 is low in toxicity, gives a dry "hand," increases tensile strength, has excellent electrical properties and is highly resistant to moisture. It is nonmigratory.

HB-40 gives excellent results in extrusions, organosols and vinyl injection moldings as well as in films. For further information, mail the coupon or contact the nearest Monsanto Sales Office.

Properties:

Penta protects deck of 54-ton trailer



The deck of this 54-ton, drop-frame trailer has to be strong . . . and stay strong. That's why its manufacturer, La Crosse Trailer Corporation, La Crosse, Wisconsin, protected the 21/2" oak decking with a formulation of Monsanto Penta (pentachlorophenol). Penta protection is a clean treatment that guards wood against termites and other wood-boring insects . . . against the attack of fungi that cause wood decay. Penta can be applied by brushing, dipping or pressure methods. It is a chemically stable treatment that cannot be washed away by rain or ground water. Properly formulated penta treatment leaves wood paintable. If you have a problem of wood preservation, it will pay you to investigate Monsanto Penta. For further information, mail the coupon or contact the nearest Monsanto Sales Office.

Mold in soap wrappers stopped by Santobrite

For as many years as manufacturers have been wrapping bar soaps, they have been plagued by the action of fungi in their wrapping papers. The use of as little as 2.0% (on weight of casein in size) of Santobrite* (sodium pentachlorophenate, technical) controls these microorganisms in casein-coated papers. The addition of Santobrite in the paper stock and in the glues used for sealing also is recommended.

Investigate the possibilities of Santobrite as a means of solving your problems of mold in soap wrappers. For further information, mail the coupon or contact the nearest Monsanto Sales Office.

FOR YOUR LIBRARY

Timely Monsanto publications, listed below, will be sent to users of chemicals on request... free and without obligation. Indicate the literature you want on the coupon.

Technical Bulletin No. O-33—Contains information on Santolube* 31, an additive for use in hydraulic oils, rust preventives, cutting oils, stationary engine lubricants and others.

Technical Bulletin No. 0-52 — Describes Niran, Monsanto's parathion, an agricultural insecticidal chemical.

Technical Bulletin No. 0-62—Giving information on Santolene* C, a newly developed metal corrosion inhibitor for light petroleum products.

Technical Bulletin No. P-133—Gives data on Sterox* SE and Sterox SK, 100% active, liquid, nonionic-type, surfaceactive agents, wetting agents, emulsifiers and detergents.

Technical Bulletin No. P-129—Presents technical data on Sterox CD, a nonionic-type, liquid, 100% active emulaifier, detergent, surface-active agent.

Technical Bulletin No. O-16—Featuring Santomask * II for "after-odor" control of paint, printing ink and other compositions.

Technical Bulletin No. O-D-601—Data on OS-16, flame-resistant hydraulic fluid.

Technical Bulletin No. P-146—Describing the use of Santomerse S for metal processing in acid media.

Technical Bulletin No. P-101-Featuring SA-326, an antioxidant for soaps.

New furnace steps up phosphorus production

A new electric furnace, world's largest, is being built by Monsanto Chemical Company at Monsanto, Tennessee, where the company produces phosphorus of better than 99.9% purity. Monsanto converts phosphorus into phosphoric acid and various phosphates.

Here's a new service for the food industry



A new laboratory to study the application of chemicals in foods has been set up by Monsanto at Anniston, Alabama, and is ready to work on such problems for the food industry. There is no charge for investigational work by the laboratory, one of the few such establishments in the chemical industry.

The illustration shows Dr. Roy E. Morse, food technologist, conducting an experiment in tomato canning. For further information, mail the coupon.

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Its Brinell hardness ranges from 550 to 650 when sand cast, and 600 to 725 when chill cast.

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The strength and toughness of Nt-Hard castings are increased fifty to eighty per cent, without loss in hardness or abrasion resistance, by a stress relieving treatment at 400-450°F. User experience has demonstrated the merit of specifying this treatment.

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Applications include: grinding balls, ball and rod mill liners, slurry pump parts, flotation impellers, piping, scoop lips, classifier shoes, roll heads, pulverizer rings, chutes and hopper liners, muller tires, plows, pug mill knives, clay augers. Also coke grizzly discs, crusher rolls, coal mine pumps, dredge pump impellers, liners, rings and sleeves. Also industrial food grinding burrs and attrition mill plates.

AVAILABILITY

Try Ni-Hard wherever you encounter severe abrasion. See for yourself how its remarkable properties minimize replacements and repairs.

Authorized foundries throughout the country readily produce NI-HARD castings in all forms and shapes common to the iron and steel foundry.

INFORMATION AVAILABLE

Full information is yours for the asking. Write for the booklets, "Engineering Properties and Applications of Nt-HARD", and, "Buyers Guide for Nt-HARD Castings."

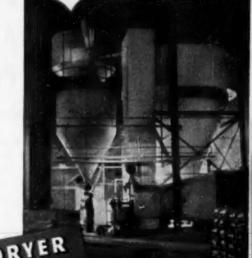


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It is but one of many applications of Swenson* Spray Dryers in the process industries. We will welcome an opportunity to assist you in adapting this equipment to your particular drying problems. Have you sent for our descriptive Bulletin D-105?



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Direct-fired spray drying may be used for such materials as:

> Silica gel Kaolin clay Manganese sulfate Calcium carbonate Chrome sulfate Sodium phosphate

Flow sheet shows typical spraydryer installation for handling heavy chemicals.

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At 100° Centigrade -

Conversion of CO To CO,

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Reactions Complete — i.e. Less Than One Part Per Million Remaining

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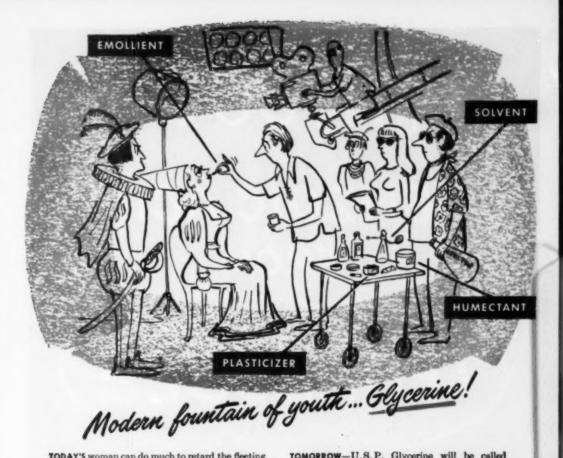
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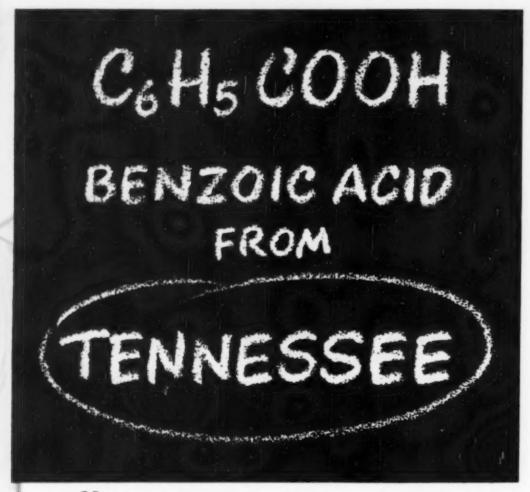
TODAY'S woman can do much to retard the fleeting years—thanks to a host of familiar beauty preparations! Similarly, she owes a vote of thanks to versatile U.S. P. Glycerine, said by one cosmetic authority to have "the quality of imparting brilliance, softness, and delicate coloring to the skin, when properly applied." Millions of pounds flow into the cosmetic industry yearly where it serves as a humectant, vehicle, emollient, softener, "bodying" and spreading agent—in almost every conceivable type of cosmetic preparation! Why? Because U.S. P. Glycerine is outstandingly safe for human use and because no single material has the properties to replace Glycerine in its multiple applications! You'll find the story of these many applications clearly outlined in our booklet "Why Glycerine for Drugs and Cosmetics" Write for your copy today!

TOMORROW-U.S.P. Glycerine will be called upon to perform a variety of tasks, often in a single cosmetic product. Not only because Glycerine improves the quality and performance of toiletries—but also because it exerts beneficial effects upon the skin! Indeed, a European survey has already indicated that there is no adequate substitute for Glycerine in cosmetic preparations. Glycerine-the time-tested component-is frequently a major ingredient in new compounds . . . for example in the insect-repellent cosmetics now undergoing extensive tests by the U.S. Bureau of Entomology and Plant Quarantine. A typical cream formula and condensed progress report on the subject will be sent on request. (Please use your company letterhead.) Here again, in cosmetics "news"-nothing takes the place of that are Glycerine!

Nothing takes the place of Glycerine



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More and more buyers of chemicals are becoming quality conscious, and particular buyers are conscious of quality in chemicals from Tennessee.

Dependable quality is assured because we produce our chemical products from basic raw materials under conditions of rigid laboratory supervision. Integrated production is a safeguard of quality. It enables Tennessee to maintain strict "on time" deliveries.

We'll gladly send you specifications. Stocks at key points enable you to get deliveries without delay.

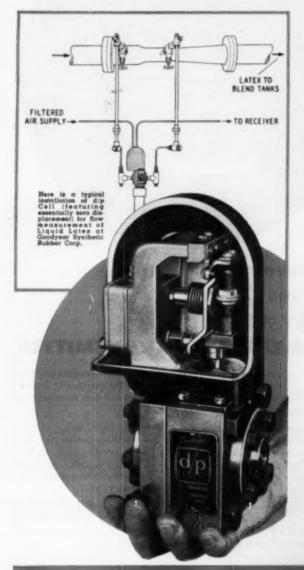
For particular needs in heavy or fine chemicals, it's a good rule to see that they always come from Tennessee.



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NASHVILLE, TENNESSEE



NOW - measure flow of viscous or corrosive fluids without seal pots



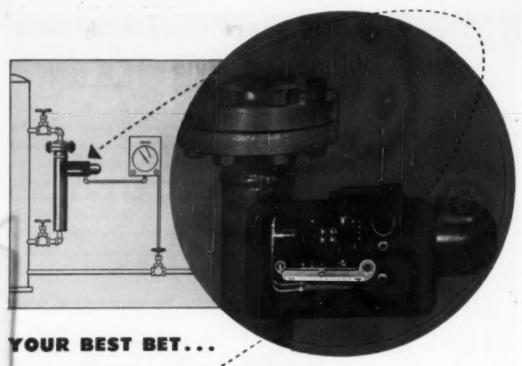
You can cross seal pot troubles right off your list when you measure the flow of viscous or corrosive liquids with a Foxboro d/p Cell (differential pressure pneumatic transmitter). Goodyear did it very successfully on one of the toughest jobs... the control of latex flow to a coagulator. Here are the results obtained by this leading manufacturer through the use of the mercuryless d/p Cell:

- A. 83% reduction of instrument cleaning and maintenance costs.
- B. No unscheduled production shut-downs for instrument maintenance.
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These cost-saving achievements were made possible by the elimination of seal pot disadvantages . . . (frequent and time-consuming clean-outs, constant risk of clogging, instrument inaccuracies, etc.). A complete "Technical Report on Savings Effected at Goodyear Synthetic Rubber Corporation through Control of Latex Flow by d/p Cell" is available. Send for a copy and details of the unique d/p Cell. The Foxboro Company, 248 Neponset Ave., Foxboro, Mass., U. S. A.

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d/p CELL for better flow measurement



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THE HONEYWELL DISPLACEMENT-TYPE TRANSMITTER

Today's continuous processes demand the type of liquid level measurement best provided by this Honeywell Displacement Type Transmitter. Its outstanding features include unusual sensitivity (1 part in 5,000), friction-free design and high speed response (less than 5 seconds, full range).

It affords dependable measurement of many different liquids (Sp Gr 0.3 to 2.0) without changing parts...unaffected by ambient temperatures and vibration. Neither purge nor liquid seals are required. It is easy to clean. It is available in nine operating ranges for level measurements from 0" to 120"... with connections to suit all usual process vessels. It may be connected to any pneumatic receiver... indicator, recorder or controller... and operates with a full range of transmitted air pressures from 3 to 15 psi.

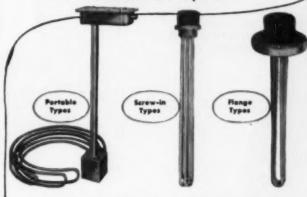
For more detailed information about this transmitter, call in your local Honeywell engineer... he is as near as your phone? MINNEAPOLIS-HONEYWELL REGULATOR Co., Industrial Division, 1904 Windrim Ave., Phila. 44, Pa. Offices in more than 80 principal cities of the United States, Canada and throughout the world.



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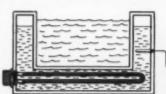


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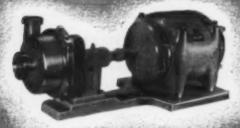
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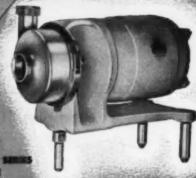
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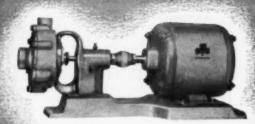
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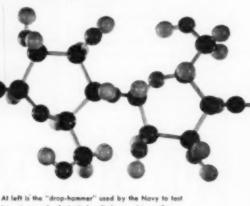
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. . . to find a more durable material for tool handles . . . which would retain its original form and finish under the severest use conditions; not crack or shatter, even if mistreated; and not become loose when subjected to wide variations of temperature.



SOLUTION ...

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impact strength of plastic-handled screwdrivers. Superimposed is a model depicting the long and complex molecular structure of cellulose—the secret of ethyl cellulose's great strength.

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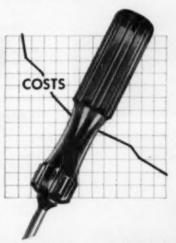
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. . . colorful, permanently attractive tool handles that are not only super-tough, but non-conductive and economical to mold or fabricate. Their use by the automotive and other industries has meant a marked decrease in replacement costs.





Hot Lacquer is Hot News

Wearing hot-lacquer coots, a group of new and old cars is providing Hercules with a mobile proving ground for the relatively new technique of spraying high-solids lacquers at elevated temperatures. Furniture manufacturers also are rapidly adopting the process.

Neat, rother than high solvent content, motes the lacquer fluid enough for spraying. Less solvent and higher solids mean thicker films when dried, fewer coats required, increased production capacity, and minimum rubbing. Write for folder, "The Case For The

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The Case for Casein

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"Hercoftex" 290 (octyl decyl adipate) is the third in a series of vinyl plasticizate to the amounced within recent months by Hercofes. Possessing the low volatility usually restricted to phthalates, this adipate-based ester contributes exceptional low-temperature properties and improved "drape" to vinyl film and sheeting.

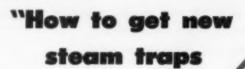
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Trade steam losses for them...



(Assuming steam costs 50 cents per 1000 fbs

Size of Orifice	Lhs. Steam Wasted Par Month	Yotal Cast Per Manth	Yotal Cast Par Year
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3/8"	470,000	235.00	2,820.00
1/4"	210,000	105.00	1,260.00
1/8"	52,500	26.25	315.00
1/16"	13,200	6.60	79.20
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In Armstrong traps the discharge valve is water-sealed at all times—no steam gets to it. There's no chance for dirt to hold the valve open and let steam escape. Armstrong traps don't COST money, they SAVE money. Ask your nearby Armstrong representative to figure on the traps you need now.

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SEND FOR THE STEAM TRAP BOOK. It tells how to figure condensate loads, how to select traps. Includes prices, data, capacities of Armstrong Steam Traps. Write for your copy.



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- Profitably used for ByProduct Recovery Produce
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The above illustration shows BUFLOVAK Evaporators used in the recovery of zinc sulphate and zinc chloride from pickle liquor. The evaporators are equipped with patented Salt Separators.

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- They are successfully used for the recovery of by-products; such as, stillage, pickle liquor, black liquor, whey, mercerizing liquor, sulphite waste, steep water, and other valuable wastes in many industries.
- 3 Such products are converted into salable or reusable materials by efficient evaporation methods. Some by-products are also dried with BUFLOVAK Equipment.
- It's a new source of added profits. And, it puts additional dollars in your pockets through savings in steam and cooling water, that come from multiple effect evaporation economies.
- 5 Disposal problems are profitably solved; and stream pollution is prevented.

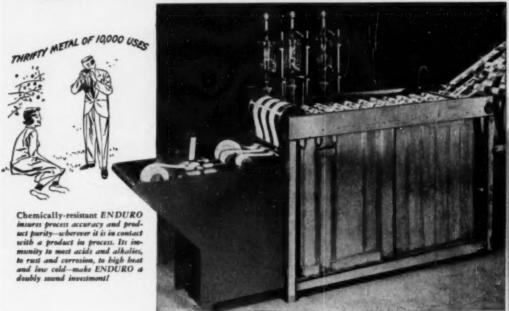
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Wherever chemistry contributes to industry —foods, industrial chemicals, processing—there ENDURO can contribute substantially to PROFITABILITY. May we send you the details?

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AC, 63 to 250 KVA DC. 75 to 200 KW

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AC to DC, AC to AC DC to DC, DC to AC

Open Protected, Splash Proof, Totally Enclosed Fan Cooled, Explosion Proof.

Ball Bearing motors are factory lubricated for sav oral years' normal service. Bearing housing con-struction permits easy re-lubrication when enusus service demands it.



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Totally Enclosed Fan Cooled



Explosion Proof

o guard your production against the destructive effects of atmospheric hazards, Century offers four types of protective motor frames.

DRIP PROOF — meets the requirements of most installations. Use it where operating conditions are relatively clean and dry. Top half of the frame is enclosed to keep out falling solids and dripping liquids.

SPLASH PROOF—keeps splashing liquids out of the motor even when the frame is washed with the full force of a hose. Use Century Splanh Proof motors indoors or outdoors.

TOTALLY ENCLOSED FAN COOLED .- resists the hazards of abnormal concentrations of dusts, powders, grit, oil mists, acid and alkali fumes.

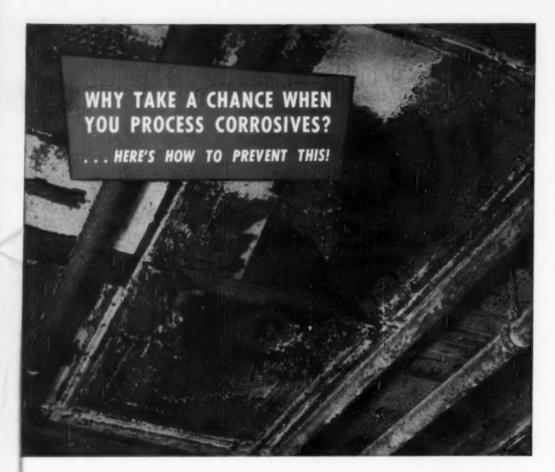
EXPLOSION PROOF—protects life and property in atmospheres charged with explosive dusts or vapors.

The properly selected protection with the wide variation of starting torque characteristics to choose from provides long operating life and improves the produc-tion of the driven equipment.

Century motors are available in a wide range of kinds and types—in sizes from ½ to 400 horsepower—for single phase, polyphase and direct current applications. Specify Century motors for all your electric power requirements.

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THE Chementator

AN APPRAISAL OF TREND-MAKING NEWS IN THE CHEMICAL PROCESS INDUSTRIES

Prepared under the editorial direction of Joseph A. O'Connor, News Editor

Westvaco: into the phosphorus big time

A third electric furnace for the production of elemental phosphorus will be constructed for the Westvaco Chemical Division of Food Machinery & Chemical Corp. at its Pocatello, Idaho, plant, where two phosphorus furnaces are now in operation. Bechtel Corp. expects to have the new furnace built by late spring of 1951. By then, Food Machinery will have pumped close to \$15 million into Pocatello. When all three furnaces are producing, the plant will be able to turn out roughly 30,000 tons of elemental phosphorus a year. At this rate, it won't be many years before Westvaco is crowding Victor and Monsanto for supremacy in phosphorus.

Power will come from the hydroelectric system of the Idaho Power Co., phosphate rock from nearby deposits on the Fort Hall Indian Reservation. The phosphate rock is supplied under a long-term contract by J. R. Simplot, who has 2,400 acres under lease at Fort Hall. Reportedly, Simplot once turned down an offer of \$5 million for his fertilizer holdings. But don't be surprised if he sells his leases and mineral rights to the phosphate rock at Fort Hall to Food Machinery before long. Thus integrated back to the phosphate rock, and with its vast trona deposits at Westvaco, Wyo., Westvaco is fast becoming the dominant producer of fertilizer ingredients and chemicals in the booming Intermountain area.

Westvaco is also carrying its integration in the other direction, closer to the consuming industries. At Lawrence, Kan., a plant will be erected for the processing of phosphorus into soluble phosphates for the soap, textile, oil and chemical industries (see Chementator, June 1950, p. 80). According to Bechtel Corp., it is slated for completion by spring of 1951. The site, on the Kansas River some 35 mi. west of Kansas City, Mo., was picked not only as a likely spot for a phosphate unit but also with an eye toward future expansion into other chemical operations.

Chomical industry urged to tell its story

Chemical industry's chief task is to increase public awareness of its efforts in fighting air and stream pollution, improving safety records, lengthening lives and "serving humanity in countless ways," asserts MCA President George W. Merck. Merck, who is chairman of Merck & Co., Inc., says the industry's accomplishments in these fields could be largely overlooked unless the public is shown that "we are doing the right thing."

Because of the industry's rapid growth, Merck points out, most of its members fail to realize that "we are about the largest one in the United States today." This imposes an even greater responsibility, he says, to "see to it that we deserve and gain a high opinion in the minds of the people."

Let industry tackle nuclear power

Give the job of developing nuclear power to industry, urges Charles A. Thomas, executive vice president of Monsanto, and give the job to industry immediately. Specifically, Dr. Thomas suggests that a 75,000-kw. power plant could be built in Idaho to provide electric energy for production of phosphorus.

His plan includes AEC supervision of uranium and the recapture of plutonium. For the production of plutonium, industry would get a fee to help offset the cost of power. Even so, the government would be getting its plutonium cheaper than it can be produced at the government plant at Hanford, Wash. Thus his plan suggests a way of meeting the great initial cost of full-power reactors, which is estimated at from \$20 million to \$100 million.

While some of the biggest U.S. corporations now operate AEC plants, they do so as contractors. Hence they have little opportunity to work on their own with free rein, private capital and American technological genius.

Chemical industry opposes tariff cuts

Representatives of major chemical producers appeared before the Committee for Reciprocity Information in Washington recently to give the government their opinion on tariffs. They were unanimous in their opposition to any cuts in import duties.

The committee is gathering information for use when reciprocal trade agreements are discussed at Torquay, England, this fall. At that time 17 nations will meet with representatives of this country to consider American tariff reductions.

Under the Reciprocal Trade Act, the President (Continued)

THE CHEMENTATOR, continued

has the authority to enter into tariff negotiations with other countries for the reduction of tariffs. He can cut tariffs up to 50 percent of the existing rates. In 1947, the U.S. and several foreign countries agreed to reduce tariffs on many items. More tariffs were reduced in the summer of 1949. The Torquay conference will be a "third round" in tariff cuts.

A large number of chemical items are being considered for tariff cuts. A number will run the risk of losing any tariff protection whatever.

Within the scope of the items proposed for tariff reduction, for example, is a list of 200 chemical compounds manufactured by Dow. Only 37 of these products are mentioned by name in the tariff. The rest are included either by class or derivation.

U. S. Industrial Chemicals recommends that tariff duties on the following chemicals in particular should be maintained at existing levels: synthetic resins, acetic acid, acetaldehyde, butyraldehyde, ethylene glycol, acetone, methyl ethyl ketone, amyl alcohol, fusel oil, butyl alcohol, propyl alcohol, ethyl ether, and collodion and other pyroxylin solutions.

A reduction in the tariff on phenol, for example, which would permit foreign producers to export phenol into the United States, might force American producers out of business and all United States industries that use phenol might become dependent on foreign producers. Phenol, a highly critical material during World War II and an essential building block of the chemical industry, can be produced in low wage scale countries at costs substantially lower than in the U. S. The average wage rate paid by Dow, as an instance, is approximately 360 percent that of the rates in Great Britain for companies that are producing competitive chemicals.

Tariff cuts are opposed at this time for three major reasons: (1) they will lead to unemployment; (2) retard the technological and economic development of the nation; and (3) weaken the national defense.

Donald K. Ballman of Dow, in his appearance before the committee, stated that the ability of the U. S. to remain self-sufficient in synthetic rubber and many other strategic materials might depend upon the government's tariff policy. Reduction in tariffs would also weaken national defense.

"The best in fuel, lubricants, alloys, equipment, medicine, protective clothing, and explosives are created by aggressive research supported by the chemical industry," Ballman said.

"The American chemical industry must keep pace with the times. New materials must not be developed and manufactured only on the other side of the ocean. The American chemical industry must not be placed at such a disadvantage that it cannot afford to do the research and development necessary before new prod-

ucts are brought to the market. Money won't be invested for new plants if there is no opportunity for the American producer to sell," Ballman further declared.

President William M. Rand of Monsanto, who is also chairman of the Manufacturing Chemists' Association, charged that reduction of American tariffs at this time would stimulate still further the construction of more and more chemical plants within the Russian orbit and in areas subject to seizure or control by the Soviets.

"Foreign competition is unfair when state-controlled industries employ slave labor, currency devaluation, exchange rate juggling, state trading and other ruthless trade practices which are not and cannot become a part of our system of free competition among private enterprises," Rand said.

Expressing sympathy with any movement that would promote international trade, Rand added that foreign markets would be of little consequence if America's domestic economy was adversely affected.

"Our first obligation to the world is to maintain our domestic economy and full employment," he warned.

Industry spokesmen believe that any reduction in chemical tariffs will result in the encouragement of plant construction or expansion in areas now dominated by or subject to being overrun by powers whose avowed goal is world domination.

Importance of chemicals in the national economy was stressed by industry representatives. The chemical process industries represent the largest single segment of American industry, being larger than food or iron and steel.

"In time of national emergency," Rand pointed out, "the role of chemicals is even more significant.

"History shows that this country was utterly dependent upon foreign supply of organic chemicals at the time of World War I. The last war found us in a far stronger position. Under the tariff protection which was fostered in the 1920's and 30's, the organic chemical industry was able to develop intensively. It grew to the point where it supplied our entire domestic requirements—and most of our allies—and made victory certain in the most highly scientific war yet fought."

Pensions the sorespot in Solvay strikes

Pension demands of workers touched off strikes in mid-June that closed plants of Allied's Solvay Process Division. Strikes began on June 13 at Solvay plants in Syracuse, N. Y., Detroit, Mich., and Baton Rouge, La., when members of District 50, United Mine Workers, began picketing.

The strike took 2,000 Solvay employees from their jobs at the Syracuse plant. Andrew Hiznay, field representative of District 50, United Mine Workers, said there was "nothing new" in the walkout. A Solvay (Continued on page 78)

From SHELL CHEMICAL

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and authorized grades*

- *NEOSOL-a proprietary solvent
- *SPECIALLY DENATURED GRADES
 as authorized by the Alcohol Tax Unit of the
 U. S. Treasury Department.

When you need clean alcohol with exceptionally mild odor... when consistent quality is important... consider Shell Chemical as a prime source to fill your needs. Shell Chemical's Ethyl

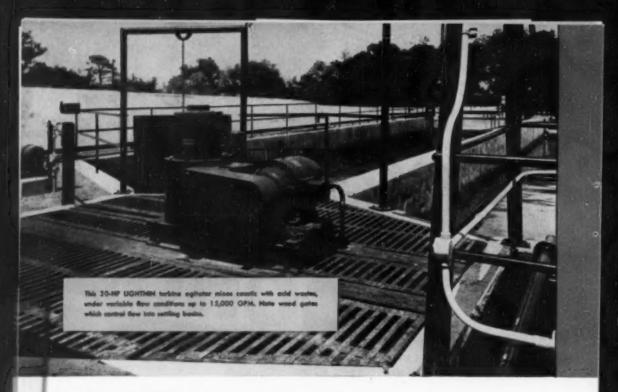
Alcohol is derived synthetically from ethylene . . . under rigidly controlled conditions. Samples and further information will be sent upon receipt of your letterhead request.

SHELL CHEMICAL CORPORATION

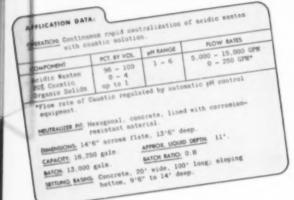
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Lightnin Mixers HELP MAINTAIN CLOSE PH CONTROL AT HIGH VARIABLE FLOW RATES



MIXCO Analysis: Flow rates specified gave a retention time of 0.87 to 2.6 minutes. To obtain a minimum of 2.1 turnovers with maximum flow, a turbine pumping capacity of 32,000 GPM was required. Turbine factor was calculated as 1.54, on basis of turbine location, acid sp. gr., viscosities, tank shape and baffling. Exclusive MIXCO agitation data showed that a stabilizing ring could be used, rather than a steady bearing, on the required 11'9" shaft.

Solution: LIGHTNIN Model 5D-WQ-3000, 30-HP Agitator, with V-belt drive from 1750-RPM motor, to provide output shaft speed of 61 RPM. Belt permits 25% speed reduction if required. Agitator equipped with dual 48" multi-blade flat blade turbine impellers, spaced properly apart on shaft. Turbines selected for full motor loading. All immersed parts made of Hastelloy B, to resist corrosive action. Tank fitted with three baffles at midpoints of alternate sides.

Results: Extremely close pH control. All organic solids are held in suspension and carried over to settling basins. The LIGHTNIN Agitator has given trouble-free service since installation two years ago.

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ENTERING AGTATORS

Turbins, propelier and
poddle types. For open
or closed tenis, Fixed or
varioble speeds availcities in heavy duty drive,
34 to 200 HP, Send for
Catalogs 8-89, 8-78.



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For tanks up to 5 million gallons. Goo motor or V-ball drive; motorious types Sizes 1 to 25 HP, Sand for Catalog 9-76

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NEUTRALIZER MY

This case story illustrates how MIXCO engineers take hold of any fluid agitation problem ... and work it out to a happy solution.

MIXCO Technology lets you know in advance what the results will be. Equipment is sized from exclusive engineering data, based on MIXCO's 25 years as fluid agitation specialists. Every installation is performanceguaranteed.

LIGHTNIN Mixers are the world's most complete line of standard ready-to-use units. Lightnin gives you unlimited range of variables, from standard components. Widest choice of

accessories, materials and modifications assures quick, accurate sizing of the agitator to your exact needs.

LIGHTNIN Standardization means prompt deliveries from stock . . . fast, easy parts replacement . . . lower first cost . . . proved maintenance economy.

Before going ahead with any process that can be helped by fluid agitation, save yourself time, research and expense by calling in MIXCO engineers. Write today, describing the application. Your inquiry will receive prompt, courteous attention.



For descriptive literature on LIGHTNIN Mixers, check and mail coupon today

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Company

Address

THE CHEMENTATOR, continued

spokesman at Syracuse, H. Edward Rowlands, assistant to the vice president, characterized the situation as "delicate."

At Baton Rouge, more than 500 production and maintenance workers were on strike. William Bunch, UMW field representative there, said the whole production force was out.

Union and company officials said the strikes were over a \$100 pension plan. The plan sought by the union reportedly is without inclusion of Social Security payments. The pension and welfare plan that the workers want is somewhat similar to that of the coal miners. Workers claim the plan would cost about 8 c. per man-hour above the present scale of \$1.63 to \$2. Wages as such were not involved.

According to James Walsmit, plant manager at Baton Rouge, Solvay already has a plan recently revised upward to equal plans accepted in the automobile and steel industries.

What to do about the benzene crisis?

WAY OUT—Synthetic rubber producers and manufacturers of polystyrene plastics are still scrambling for all too scarce styrene. But it takes benzene to make styrene. And since the coal strike, benzene production has never caught up with demand. Now one new possible way of relieving this situation glimmers on the horizon. It may work.

CUT DOWN ON STYRENE—The rubber companies have come up with the idea. Why not lick the benzene shortage, they ask, by cutting down the amount of styrene that goes into GR-S tire rubber? Change the ratio of styrene to butadiene, they say. One firm has gone so far as to suggest that instead of nearly a third of styrene in the copolymer, the manufacture of GR-S rubber should be based on a 20 percent formula. This would cut back by one-third the need for styrene, and thus the need for benzene.

Before the rubber makers' idea can be tried out, however, the government will have to overhaul its synthetic rubber policy. Up to now, the government has required all copolymer plants to stick to the standard ratio of 29 percent styrene to 71 percent butadiene in the production of synthetic for tires. Thus a uniform product came from all government GR-S plants. This made plant control easier, and it facilitated tire making. Now, however, this policy may have to be changed. The only alternative is to produce less rubber. For there just isn't enough benzene to make the styrene that would be required using the old ratio.

EVEN ELIMINATE IT—Carrying this idea to its limit leads to the manufacture of polybutadiene, a tire rubber made wholly without styrene. Phillips Petroleum has successfully produced polybutadiene rubber by mixing the polybutadiene latex with high-abrasion furnace carbon black before conversion to

solid rubber. The new rubber is made at moderately low temperatures; it is much softer than usual. What's more, it can be made in present GR-S plants with no change in equipment. Already, Rubber Reserve has scheduled production of this polybutadiene rubber for use in tires for further road tests.

OR SUFFER SETBACKS—At mid-year, the benzene famine is holding back the development of promising markets for synthetic rubber and polystyrene plastics. Each of these big consumers of styrene needs at least 5 million or 10 million gallons additional to finish out this year at wanted rates of production. Still further growth in manufacture of synthetic rubber and polystyrene plastics is sure for future years, barring a major business setback.

TILL NEW SOURCES OPEN UP—Somehow the chemical process industries of the United States have got to scrape up 1 million or 2 million gallons more per month of benzene. Where this will come from is not yet clear. European sources are being drained by U.S. buyers abroad. Coke-oven manufacture of benzene continues at peak pace. Synthesis from petroleum is growing. Pan American at Texas City can produce 3 million to 5 million gallons a year; Shell at its Wilmington, Calif., refinery is also making synthetic benzene. But high prices hinder volume production from this source. Users might pay 25 c. to 30 c., but most of them balk at 35 c. to 40 c., which petroleum executives think they must ask to recoup their initial investment at a reasonable rate.

For the immediate future, all this adds up to one sure thing: more trouble for the buyer of benzene.

Terylene: Du Pont evaluates it

Whether Du Pont goes ahead with plans for an \$8 million plant to make polyethylene terephthalate synthetic fiber hinges on the outcome of evaluation tests now under way. Both consumer and industrial applications of the new fiber, which Du Pont calls Fiber V, are being evaluated.

Technically, the material is a condensation polymer obtained from ethylene glycol and terephthalic acid. Present production is limited to experimental quantities of continuous filament yarn and staple being turned out at Du Pont's Seaford, Del., plant.

out at Du Pont's Seaford, Del., plant.

Fiber V has high tensile strength and high re-

Fiber V has high tensile strength and high resistance to stretching—both wet and dry. It resists abrasion and degradation by chemical bleaches. Most of the fiber's properties are equally good under wet or dry conditions. Fabrics made from Fiber V are resilient; they resist wrinkling, launder easily, dry quickly, and can be heat-set. A wide range of filament deniers is possible. The fiber has good electrical insulating properties; it is not weakened by fungus, mold or mildew.

Du Pont has not decided on a name for Fiber V. (Continued on page 80)

We Broke This "Broom-tail"



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NEW CHEMICAL TOOLS

To the chemical world, Elemental Fluorine has long been a wild, unbridled bronco . . potentially useful, but highly hazardous and too hard-to-handle. Now, General Chemical has broken this "broom-tail" as a part of its continuous research in the field of fluorine chemistry. In such seasoned hands, elemental fluorine is ready to work for you!

Today, General Chemical makes Elemental Fluorine in tonnage quantities. From it, General can produce a wide range of new fluorine derivatives of interest in many fields.

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Using Elemental Fluorine as a process chemical requires specialized experience and highly-trained personnel, as well as a major plant investment. General Chemical already has the men, methods and materials to produce virtually any product which should be made from Elemental Fluorine or its derivatives. For your requirements, consult General Chemical . . . First in Fluorides.

Following are some of the fluorine derivatives which can be made from Elemental Fluorine, Many others are passible. For your needs, can-rult General Chemical 6122

Sulfur Hexafluoride* Cobalt Trifluoride Zirconium Fluoride Antimony Pentafluoride Tungsten Hexafluoride Iodine Pentafluoride Titanium Tetrafluoride Lead Tetrafluoride Ceric Tetrafluoride

As developed by General Chemical, Sulfur Hexafluoride was the first commercial chemical produced from Ele-mental Fluorine to be offered to Industry. The unusual thermal and chemical stability of this inert, non-toxic gas, as well as its high dielectric strength, have led to its use as an insulator in high voltage electric equipment; other interesting uses are in the process of development.





Product Development Department

GENERAL CHEMICAL DIVISION

ALLIED CHEMICAL & DYE CORPORATION 40 RECTOR STREET, NEW YORK 6, N. Y.

THE CHEMENTATOR, continued

It was first developed in England by the Calico Printers Association, Ltd., and Imperial Chemical Industries, Ltd. In England it is known as Terylene. Du Pont acquired the U.S. manufacturing rights in 1946. Development work by Du Pont, since this acquisition, has all been exploratory. No firm decision to go ahead with commercial production of the fiber has yet been made.

Air pollutions battle of the bureaucrats

A behind-the-scenes tug of war by federal agencies is disrupting efforts of congressmen to get a federal air pollution law on the books. Five such bills are on the congressional calendar. At least three agencies—Public Health Service, Bureau of Mines and Civil Aeronautics Administration—are hungrily eyeing the juicy job of administering any federal air pollution act.

While interested in air pollution, PHS isn't keen on any of the bills under consideration. Instead, it wants a law similar to the water pollution control legislation passed in 1948. Thus it could control the research grants to the states, but it wouldn't have the job of enforcing the law. Enforcement of the federal water pollution law is handled chiefly by the states. As PHS knows, "a policeman's lot is not a happy one." On the other hand, everyone loves someone with an open purse.

PHS goes about getting the law it wants in its own peculiar way. It wants the air pollution problem to be tackled, not by industrial engineers, but by "industrial hygienists." The hygienists consider themselves health workers, hence are more apt to play follow the leader with PHS. Engineers, however, look to the Bureau of Mines.

The PHS Division of Industrial Hygiene caters to the industrial hygienists. Speaking of air pollution, J. J. Bloomfield, assistant chief of the division, recently told hygienists, "I should like to think that we are all agreed that it is the job of the industrial hygienist."

One bill would authorize the CAA to study the need for smog control in the vicinity of airports in order to promote safety in air navigation. PHS objects to this bill on the health reason—the most dangerous smogs are not necessarily those that hamper visibility.

Since there are more industrial hygienists in private industry and state work than in the federal establishments, Bloomfield feels that PHS can safely give up the enforcement to local authorities and yet, through control of people working on the program, control the entire field.

Bloomfield makes no bones about it. "The control of the outer atmosphere is but a short, quick step removed from the control of the inner working environment in which the industrial hygienist is the recognized scientist," he says. "If he refuses now to apply the skills which he has acquired over a long period of years, he will be violating an ethical responsibility."

The Bureau of Mines has been working its end too. Although a national air pollution symposium, the first of its kind, was held in Pasadena, Calit., last year, the Bureau of Mines was one of the active sponsors of the U. S. technical conference on air pollution in Washington last May.

It was agreed at that meeting by most speakers that any control of air pollution must be preceded by research to identify the pollutants and their properties, and to develop sampling and analysis methods. Research must also first determine the chronic effects of exposure so that threshold values of contaminants, similar to the maximum allowance concentrations used in industry, may be developed.

The PHS hopes to enter into air pollution control through the research door. Its Industrial Hygiene Division is already engaged in this research.

Step on the propane, driver

By 1952 at least 20 percent of the nation's urban buses will be using propane. So predicts President L. J. Fageol of the Twin Coach Co., a leading bus manufacturer. "Ultimately gasoline or diesel buses will be as rare on the nation's highways as horses and buggies," he says.

Fageol ought to know. Recognized as the propane pioneer of the bus industry, he's been experimenting with this fuel since 1935. Six years ago he introduced the 10-to-1 compression ratio engine, still the only bus engine expressly designed for propane. Now he's turning out the world's first standard line of propane buses.

How big a dent would this switch make in the U. S. supply of propane? "If all of the nation's urban buses were to suddenly operate 100 percent on propane," estimates Fageol, "their total requirements would be only 625 million gallons annually. Addition of this amount to the present U. S. propane consumption of 2½ billion gallons yearly would represent a total annual demand of only 3½ billion gallons. Petroleum industry authorities now estimate our available supply of propane at 15 billion gallons annually. Obviously, we would still have 11½ billion gallons of unused, surplus propane capacity. It is apparent that the day of propane shortages and increased prices is still very far off."

Conversion of leading bus lines to propane is proceeding at a rapid rate, according to Fageol. He states that his company now has propane-powered units on order from 10 large operators and that its backlog is increasing rapidly. Among the major transit cities now using propane are Los Angeles, Wichita, Galveston and Fort Wayne. One big advantage of propane: its exhaust is colorless and odorless. —End

When Toluene Derivatives Are Indicated As Intermediates Hooker Offers You Many Advantages

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Data sheets on Hooker Toluene derivatives are available when requested on your company letterhead. Bulletin 320 gives more details on the reactions of these products.

BENZYL CHLORIDE

Synonym	Alphaehlorotoluene
Formula	
Molecular Weight	
Freezing Point	
	5° or less including 179.4°C
	25/D
Specific Gravity, 15.	.5°/15.5°C

Colorless to light yellow liquid having a pungent odor. The above data are for the high grade product. Also available as a technical grade with a wider distillation

In manufacture of intermediates, dyestuffs, perfume bases, plasticizers, resins, wetting agents, rubber accel-crators, gasoline gum inhibitors, pharmaceuticals.

BENZOIC ACID

Synonym										.1	H	M	10	ıy	łi	a	r	n	ic	1	kcid
Formula					٠					į.					€,	Ų	н	ü	ο	o	OH
Molecular Wt																				12	22.1
Melting Point																		1	2	2.	0°C
Solubility, gms/1	00	111	111	ø																	
Solubility, gms/1 Water at 18°C										į,						ò				3	1.27
Alcohol at 15°	C.				÷		i			0					į.	ı					32
Ether at 15°C																					
			1		ď	í										í					

White, odorless, crystalline solid, sold in powdered form. U.S.P. grade meets requirements of U.S. Pharmacopeia XIV. Technical grade does not quite meet

these requirements.

Dyestuff intermediate, manufacture of perfumes and pharmaceuticais, manufacture of beasoates; preserv-ative for textile sizing, foods, connetic creams, lotions, antiseptics, dentifrices, and other pharmaceuticals.

SODIUM BENZOATE

Synonym.											1	Вн	10	W	04	n/l	8	a	ŧ.	Sc	da
Formula.											0			€	W.	19	d	X.	Э	O	Na
Molecular	Wt.																		J	14	4,0
Solubility,																					
Water a	it 25	101	3.																	.6	2.5
Alcohol	at 5	25	C																		2.3

DESCRIPTION

Hooker Sodium Benzoate is a white, odorless, crystal-line solid in flake or powdered form. Available in two grades, U.S.P. and Technical.

Chemical intermediate; preservative for foods, and as an antiseptic in pharmaceutical and cosmetic prepara-tions. Also recommended as a corrosion resistant additive for certain solutions.

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Do it the EASY way Standardize on POWELL VALVES



Fig. 241 - Large 125-pound from Body Bronze Mounted Globe Valve. Sizes 2" to 16", incl. Has outside screw rising stem, builted flanged yoke and regindable, renewable bronze sext and disc.



Fig. 1847 — 200-pound Stainfeen Steel Swing Check Valve with ocrewed-in cap and regrindable, renewable disc.





New 150-pound Globe Valve with screwed ends, outside screw rising stem and yells, belted flanged bennet. Fig. 2474 — Available in 18-85, 18-85 Mo, Durimet "20". Fig. 2476 — Available in Nickel, Monet, Metal, Ampce Alley, Everdur, Hastelley Alleys A-B-C. Flanged End Valved are furnished with face to face dimensions conferming to latest MSS Standards.

New 150-peund Gate Valve with flanged ends, outside screw stem and yeks, bolted flanged bennet. Fase is fase dimensions confern to MSS SP42. Flg. 2477 — Available in 18-65, 18-65 Mb, Churmet '29'-Flg. 2473 — Available in Nickel, Menel Metal, Ampoc Alloy, Evelury, Hastelloy Alloys A-8-C. Those valves are also available with screwed ends.

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When you get your valves from various sources, buying for replacement—and stocking spare valves and parts—becomes unnecessarily complicated.

But when you buy ALL your valves—Bronze, Iron, or Steel, and, if you need them, Corrosion-Resisting Valves—from ONE source, you have the answer to your flow control problems. Powell makes them all* and makes them better. Also Powell makes the only COMPLETE Line of Valves for Corrosion-Resistance available to Industry today.



Fig. 2463-G.—Standard 150-pound Stainless Steel Gate Valve with flanged ends, outside screw rising stem, belted flanged yeke-bonnet and tapered solid wedge.



Fig. 375 — 260-pound Bronze Gate Valve. Screwed ends, union bonnet, inside acrew rising stem and renewable "Pewellium" wear-resisting nickelbronze disc.

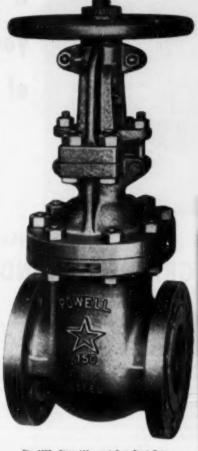


Fig. 1603—Class 150-pound Cast Steel Gate Valve with flanged ends, outside screw rising stem, belted flanged yoke, tapered solid wedge.

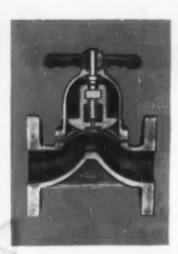
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Diaphragm gives leak-tight closure against grit, scale, solid matter... Even when something as substantial as an 8penny nail is trapped on the

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Diaphragm lifts high for streamlined flow in either direction . . . Smooth, streamlined passage, without pockets, prevents trapping of sludge and reduces frictional resistance to a minimum—irrespective of direction of fluid flow. No disc holder in fluid stream. Grinnell-Saunders Diaphragm Valves are self-draining when installed with the spindle at 15 degrees above the horizontal position.

Disphragm obsolutely isolates working ports from fluid... There's no "if" about the way a continuous, one-piece diaphragm seals off the working parts from fluids; no perforation or puncture in the diaphragm where fluid or gas can possibly leak by the valve spindle. No sticking, clogging or corroding of

working parts. Valve lubricant cannot contaminate the fluid in the line.



Diaphragm, body and lining materials to meet particular conditions . . . Bodies stocked in cast iron, maleable iron, stainless steel, bronze and aluminum: other materials on

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Diaphragmis only part that normally wears and needs replacement... Depending on the type of service, it may last for years, particularly since the compressor and finger plate combine to support the diaphragm in all positions. The diaphragm can be re-

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Here is an instrument carefully engineered so that stray light effects are negligible...an instrument where readings can be reproduced on sample after sample without "drift" er other sample after sample without "drift" er other inoccuracies, where band widths can be readily varied to permit the high resolution required in variety of absorption cells can be used interchangeably to provide aptimum path lengths...and where many other outstanding features are provided to assure maximum versatility, accuracy and dependability.

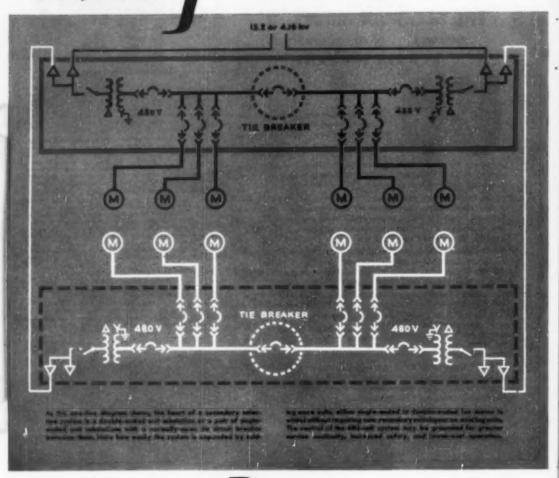
Be sure to get the full details on the many money-saving, time-saving applications for the Beckman "Model B" in today's chemical laboratories...and on the many unique advancements built into this instrument that make it such on outstanding value in its price range. See your authorised Beckman dealer—or write direct for complète data.



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secondary



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selective distribution systems

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What's behind the growing industry practice of distributing power through secondary selective systems? Primarily it's recognition of the fact that for most plants it provides a simple, lowcost way to safeguard service continuity for operations requiring uninterrupted productior.

This method utilizes a normally open tie circuit breaker between the secondaries of two transformers in a double-ended unit substation. The tie provides an alternate source of power for secondary circuits if either transformer becomes de-energized by a fault in the primary circuit.

In effect, it enables one "partner" when necessary to carry the essential load.

Simplicity is another advantage of this system. Operating personnel need no special training to operate and maintain the equipment contained in a double-ended unit substation—chiefly transformers and manually-operated drawout air circuit breakers.

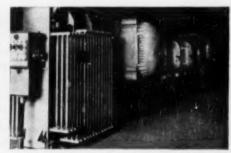
Moreover, expansion is easy and economical. Single-ended or double-ended substations can be added at will. Since no added interrupting duty is imposed, no new secondary switchgear is needed on existing units. Full data is contained in Bulletin GET-1438, "Secondary Networks for Industrial Plants." Send for your copy today, Apparatus Dept., General Electric Company, Schenectady 5, N. Y.



TO HELP CUT YOUR POWER DISTRIBUTION COSTS... Don't miss accing the 'M-sre Power to America" full color and sound slide-film 'Modern Industrial Power Distribution," It's packed with helpful, cost-cutting ideas you can use. Ask your G-B representative to arrange a showing for your organization.

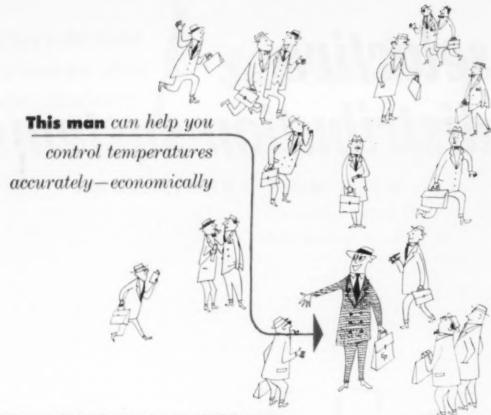


G-E double-ended lead-center unit substations for nonhazardous areas are compact, factory-assembled "packages." Shipped ready to install, they are furnished in flexible combinations of incoming-line and secondary-circuit arrangements with transformers from 100 to 2000 kvs.



For semi-hazardous areas, G-E double-ended load-center unit substations have easily removable air circuit breakers, each in Class I, Group D enclosures, plus primary power circuit breaker, a standard Pyranol $|\mathbb{R}|$ transformer section, and a secondary bus enclosure.





He's the man who can show you the proper insulation to give maximum heat and power for each fuel dollar expended

An Eagle-Picher Industrial Insulation distributor or representative can help you reduce operating expenses because he has available a wide line of insulation products—for high and low temperatures—scientifically designed for maximum thermal efficiency, and practical application. Why not let him give you more information about some of the products listed here?

These Eagle-Picher products can save you money ... power ... time

Insulating Felts • Supertemp Blocks • Blankets • Loose Wool
Pipe Covering • Stalastic • Insulseal • Insulstic • Swetchek
Finishing Cements • Insulating Cements • Fireproofing Cement
Diatomaceous Earth Blocks

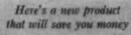


THE EAGLE-PICHER COMPANY

General Offices: Cincinnati (1), Ohio

Insulation products of efficient mineral wool - for a full range of high and low temperatures. Technical data on request.

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EAGLE-PICHER PIREPEOOFING CEMENT /104



Can be mixed with water to form a stiff plastic mix for easy application on ribbed lath. Recommended for freeproceding structural steel columns, steel tank supports, skirts and equipment bases. Has high dry coverage of approximately 30 aq. ft. 1 inch thick per 100 pounds. Adds fire protection, patented rust inhibitor resists corrosion. Tested by Underwritters' Laboratories. Inc.



For a completely effective, low-cost insulation combination, you can't beat the teamwork of Eagle-Picher Mineral Wool Blankets, Supertemp Blocks, Diatomaceous Earth Blocks and Earth Fill, and Super "66" Cement. They work effectively to give your equipment highest possible thermal efficiency . . . cut operating costs by saving the maximum amount of fuel . . . and help to provide perfect, precise control over temperatures.



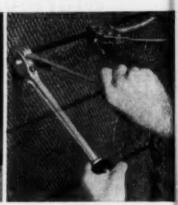
EAGLE-PICHER SUPER "66" INSULATING CEMENT

Super "66" is all-purpose, rust-inhibitive, extremely adhesive insulating cement. "Springy ball" pellets don't collapse after application... give great coverage, retain their thermal efficiency. 100 lbs. covers 65 sq. ft.—1 inch thick. Easily applied with trowel, over flat and irregular surfaces. Efficient for temperatures up to 1800° F. Reclaimable when used on equipment whose temperatures do not exceed 1200° F.



EAGLE-PICHER SUPERTEMP BLOCKS

Eagle-Picher Supertemp Blocks are lightweight (approximately 16 lbs, per cu. ft.). Can be cut easily with knife or saw to fit off-shaped areas . . . they fit snugly over minof irregularities. They're strong and have high refractory value. Withstand temperatures up to 1700° F. Conductivity at 512° F. approximately 0.43 . . . all standard sizes, from 3'x18' to 12"x36" in thicknesses from 1" to 4".



EAGLE-PICHER MINERAL WOOL BLANKETS

These blankets satisfy the need for a convenient method of quickly and efficiently insulating flat or curved surfaces on larger types of heated equipment. Mineral wool is felted and secured between flexible metal fabric. Outstanding physical and chemical stability enables Eagle-Picher Blankets to resist water steam, corrosive fumes and normal vibration.

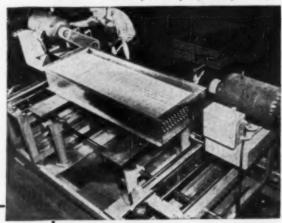
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Insulating Felts • Supertemp Blocks • Blankets • Loose Wool • Pipe Covering Stalastic • Insulseal • Insulstic • Swetchek • Finishing Cements Insulating Cements • Fireproofing Cement • Diatomaceous Earth Blocks



Special coil manufacturing equipment assures uniformity of coil quality and dependability.

In cooling or heating coils



Sturlevant

For practically every cooling or heating application, you will find a Sturtevant coil that fills your needs. Because it is built under rigid specifications by skilled craftsmen using specialized equipment, it will be a quality product—with performance proved through years of successful installations.

Take the U. S. Department of the Interior Building in Washington, D. C., as an example. The thousands of Sturtevant coils installed there in 1934 have performed perfectly ever since. This is only one of many installations with a record of 15 years or more of efficient service.

Sturtevant's complete, standardized line contains all types and sizes of heat transfer coils. They are available in a wide range of capacities, with aluminum or copper fins that offer minimum resistance to air flow and are easy to clean,

By specifying Sturtevant, you are assured of long coil life at rated performance... the product of sound engineering, modern tooling and first-class workmanship. Call your nearest Westinghouse Sturtevant Office, or write to Westinghouse Electric Corp., Sturtevant Division, Hyde Park, Boston 36, Mass. GIVES

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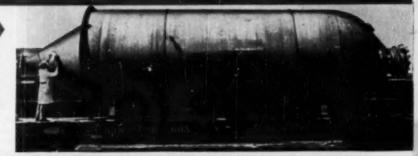
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VESSIL LIFT INSURANCE. Before this SMITH-Ilined Paper Mill Digester was manufactured, an extensive and comprehensive testing program was completed to be sure the proper alloy lining was selected for the corrosaive service. An experimental digester was built and a great many "cooks" were run before the final decision was made.





with using A. O. SMITH MULTI-LAYER CONSTRUCTION WAS MORE ECONOMICAL than single-plate construction in the manufacture of this 72 in. dia. by 80 ft. long water scrubber, at the same time providing a safer construction.

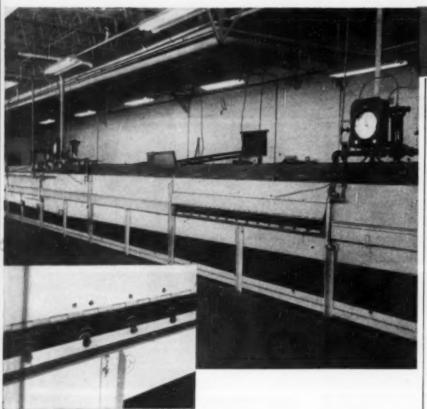


FIELD ASSEMBLY COSTS CUT TO A MINIMUM. The SMITHway is to do the maximum amount of work possible in the shop on vessels too big to be shipped in one piece. All the shell courses on this 15 ft. dia. by 113 ft. long A. O. Smith Atmospheric Tower were tacked together in the shop to get more accurate and complete installation of the internals.



CONSISTENT QUALITY OF A. O. SMITH ELECTRODES used in the manufacture of A. O. Smith Pressure Vessels is preserved by meticulous control procedures. By means of this X-ray diffraction machine, all raw materials used in electrode coating are checked for the presence of any foreign materials or impurities.

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Withou	t obligation, send us the latest A. O. Smith Vessel Bulletins
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Bearings lubricated not once a day but once in two weeks

CONVEYOR ROLLS on the pasteurizer (above) are continually subjected to water spray at temperatures ranging from 60°F. to 212°F. Under such conditions it is usually extremely difficult to Jubricate the roll bearings.

When this unit was installed, it was expected that rolls would have to be lubricated daily—a large order on a conveyor 80 feet long with rolls spaced 6 inches apart. However, a Standard Oil lubrication specialist was asked for his recommendation. He selected STANOLITH Grease—a lithium-soap product with the ability to withstand both heat and water.

The conveyor, now operating on STANOLITH, is Inbricated—not daily—but ence every two weeks. STANOLITH provides good lubrication at both high and low temperatures in the machine and is not washed away by the spray.

Lubrication problems caused by heat, water, or low temperatures in your plant can be solved by this one lubricant: STANOLITH Grease. Through its remarkable versatility, you can avoid the cost and trouble of stocking and using a variety of special greases. A Standard Oil Lubrication Engineer will help you make these savings. Write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80 Illinois



What's YOUR problem?



Mr. J. D. Clark of Standard Oil's Saginaw, Michigan, office is the lubrication specialist who helped this customer make a worthwhile saving by recommending STANOLITH Grease.

Standard's lubrication specialists are located throughout the Midwest. One of them is within easy reach of your plant. He offers you an on-the-spot lubrication service that's backed by extensive experience and training in the use of modern lubricants and fuels. He can help you make important reductions in operating and maintenance costs.

Arrange, today, for a visit of this lubrication specialist by phoning or writing the nearest Standard Oil Company (Indiana) office. Ask him to give you actual performance data on these outstanding products:

STANOIL Industrial Oils—This multipurpose line of oils provides cleaner operation of hydraulic units, supplies effective lubrication in compressors, gear cases, and circulating systems. One or two grades can replace a wide variety of special oils and lubricants.

SUPERLA Greases—Available in a wide range of consistency grades and in both lime-soap and soda-soap types, SUPERLA Greases cover a wide range of operations. These efficient products are comparable in quality with the highest type of special greases.

CALUMET Viscous Lubricants — On open gears and wire rope, these greases strongly resist washing and throw-off. Their superior wetting ability affords better coating of gears, better internal lubrication of wire tope.

STANORUST Rust Preventives—The eight grades of STANORUSTS form one of the most complete and effective lines of rust preventives on the market today. Each has been scientifically and specifically developed for its intended use. The grades range from a fingerpriat remover to a beavy petrolatum that protects against corrosion for years under the most severe outdoor exposure.

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The SANDOZ Chemical
Works, Inc., at their Fairlawn,
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Shelf Dryers in the processing of
their heat-sensitive chemicals. Stokes
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excess moisture from the finished product.

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as chemical salts, dyes, animal glands,
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Stokes Vacuum Shelf Dryers...in sizes from 2 to 22 shelves, 24"x 24" to 44"x 40", are heated by either electricity or steam... with complete thermostatic controls, motor-driven circulating pumps and thermometers.

Observation sight glasses together with swivelmounted observation lights are staggered vertically for maximum visibility.

> If you have heat-and oxidation sensitive products which require drying . . . send samples for tests at the Stokes semi-plant-scale laboratory.



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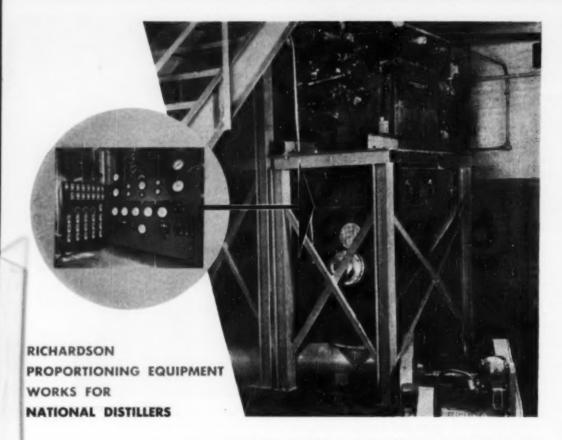
Our product samples are being sent for test drying.
 Send your bulletins on Stokes Vacuum Shelf Dryers.

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PROBLEM

To proportion corn mool, rya meal and malt to the cookers of a large distillery in a CONTINUOUS STREAM, ACCURATE BY WEIGHT.

SOLUTION:

Instellation of three Richardson Automatic Napper Scales, with a control ponel to co-ordinate scale action. Screw fooder and screw take-away conveyors provided a simultaneous, continuous, timed discharge of ingredients to the distillery cookers. The proportions of the ingredients, accurate to 1/2 of 1%, can be conveniently othered for different formulae.

National Distillers Products Corporation, in their appeal to the public's palate, must rigidly follow individual and highly intricate formulae. Doing this involves a problem in precision proportioning. To solve it, National Distillers Products Corporation called upon the Richardson Scale Company to design and build the equipment to do this job. Richardson did just that. The result: rapid, accurate blending, and an end product that is consistent and distinctive.

Engineering and building systems for materials handling by weight has been a Richardson specialty for more than half a century. There is at your service a wealth of practical experience in every branch of the process industries. Proven results reinforce our claim that there is no pre-weighing, proportioning or mixing problem that cannot be solved efficiently and economically by Richardson engineers. If your product requires accurate proportioning, why not call in a Richardson Engineer and have him survey your present methods. There's no obligation on your part—and his suggestions can point the way to more profitable operations and readier sales.

Richardson Scale Co., Clifton, New Jersey. Feeder—Weigher Systems of All Types: Automatic Bulk Weighing Hopper Scales, Including Conveyor-Feed Types—Continuous Feeder-Weighers—Automatic Bagging Scales—Bag-Sewing Conveyors—Packers—Process Control Panels. Branch offices in: Atlanta · Boston · Detroit Minneapolis · Cincinnati · Wichita · Montreal · Omaha · New York · Pittsburgh San Francisco · Toronto · Buffalo · Chicago · Philadelphia · and Houston.





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ERE'S news that should send any alkyd manufacturer running to the nearest teletype. On today's market, you can buy ADM's RO-10 Soya Fatty Acids considerably below whole oil. As a result you can produce RO-10 alkyds for less than comparable whole oil alkyds.

In addition, RO-10 Acids allow a wider choice of raw materials . . . simplify processing . . . assure a higher quality, more uniform product. Fast direct esterification increases kettle output. RO-10 Acids are made from recovered soybean oil . . . by distillation . . . and are remarkably free from the metallic soaps, hydroxy acids, aldehydes and other impurities often found in split acids.

You can order RO-10 or any other ADM vegetable fatty acids in combination with oils of any kind, in truckload, carload or tank car lots. That means nice extra savings!

Familiarize yourself with the chart at right. Then mail the coupon at the right, for samples and technical bulletins.

SPECIFICATIONS

Acid No.	195-205
Saponification No.	198-207
lodine No. (Wijs)	Minimum
Color (Gardner) 6	Maximum
Wt. per gol.	7.52 lbs.

Take the Scientific Shortcut with

ADM fatty ACIDS

You can always follow the market with the broad line of

ADM VEGETABLE FATTY ACIDS

FATTY ACID TYPE AND GRADE	PROFECTIVE COATINGS	SYMPHOTIC BESINES	2943	PUTTY AND CAULTING COMPUSED	METALLIC SQAPS	Lighte States	WAXES AND POLIDNES	PROGRESSION AND BEST BEST BEST BEST BEST BEST BEST BEST	LUBBICATING GREADES	COSMETICS	PRABMACEUTICAL
LINSSED											
Water White	X	X	X								
Regular	X	X		X	X	×		XXX			
SM-500	X.	X	2.	X	X	X		X			
SA4-600	X	X	X	X	X	×		X			
Essential Unsaturated											×
Free Fetty Acids											
SOYA											
Water White	*	X	×								
Regular	K	×	×		X	X		×			
BO-4	X.	X	X		X	X		×			
8 O-10	x	X	X	X	X	X	x	×	×		
BO-115	X.	X.	X.		X.			X.			
CORN-SOYA Distilled				X		*	×	×	×		
CORN Distilled				×		×	×		*		
COTTONSEED Double-		x			×		x	×	×		
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Coke plant producing high quality metallurgical coke purchased by Great Lakes Carbon Corporation

Customers of former Laclede Gas Light Company Coke Plant,
St. Louis, Mo., are assured of steady supply of coke and other products

We are pleased to inform the trade of our purchase from the Laclede Gas Light Company of its wellknown St. Louis Coke Plant. We will, of course, continue to meet the supply requirements of the plant's customers.

The Coke Plant has 56 Koppers ovens and 8 Piette ovens capable of producing some 250,000 tons of high quality metallurgical coke a year. Other products consist of coal tar, ammonium sulphate, nitration and industrial pure grades of benzol, toluol, zylol, crude light and heavy solvent, and crude still residue.

The plant's production will be continued under the direction of Mr. E. W. Blind, superintendent; Mr. John Adolphson, assistant superintendent, and Mr. Joseph Kohlberg, chief chemist. We take considerable pleasure in informing you that these men, who have been with the plant many years and who are well-known throughout the industry, will remain with us and continue in their former capacities.

Great Lakes Carbon Corporation has been identified with coke and coal operations for more than 30 years. We are regarded as one of the largest and most dependable suppliers of calcined petroleum coke in the world. The products of the St. Louis Coke Plant are exceptionally well related to our other activities. We look forward to serving the plant's customers, many of whom are already acquainted with our other products.

GLC Great Lakes Carbon Corporation

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Petroleum coke Calcined petroleum coke Industrial carbons

OIL AND GAS DIVISION

Crude petroleum and natural gas

BUILDING PRODUCTS DIVISION

Lightweight aggregates for plaster and con-

crete, marketed under the registered trade name Permalite

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Graphite and amorphous carbon electrodes. Graphite anodes. Carbon and graphite specialties.

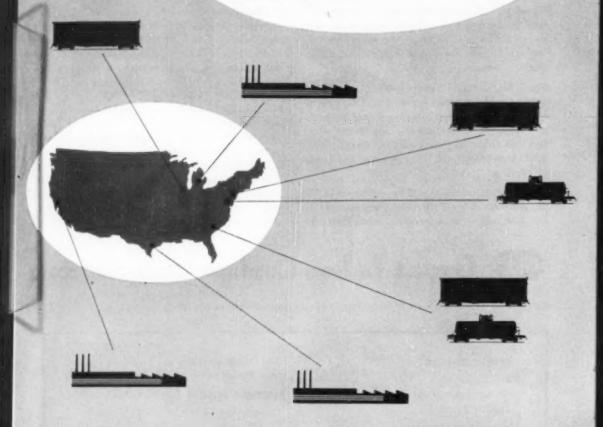
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Diatomaceous silica marketed under the registered trade name DICALITE

Dow Caustic Soda serves industry

... with unequalled distributing facilities

- Three producing plants—in Michigan, Texas and California.
- Caustic Soda Solution bulk tank terminal distributing facilities—Carteret, N. J. and Charleston, S. C.
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AND AGRICULTURE

Memo from the Editor



Our Most-Read Editor

All of you are acquainted with the work of our Senior Associate Editor, T. R. Olive, He is easily our most-read editor—partly because he's been with us 23 years, partly because he produces so much (up to 35 pages in a single issue), but mostly because he writes the sort of stuff you like (such as Plant Notebook, Equipment News, our annual reports on unit operations). He is the man largely responsible for our recent report on Process Energy which has been pulling a lot of praise.

Ted is first and foremost an engineer—precise, reliable, mentally curious. He complains, a little wryly, that his non-technical friends are so impressed with his devotion to the slide rule that they now associate him with slide rules and vice versa.

In his early teens he picked up a Smith motor wheel, one of those little red gadgets you hooked onto a bicycle. His license permitted him to use it on a bike but when he built a buckboard for it, the police drove him off the streets-it had five wheels, you see, and hence was an automobile. But he fooled them the next winter by building a skid chain to fit it and hooked it on a pair of sleds arranged in parrallel; then he could make 40 miles an hour over the icy streets of Brooklyn. That rig had only one wheel, so the cops found no way to stop him, Ted was sixteen when World War

I was on and he decided to outdo the patriotic doings of his friends. He put in six months on a Wyoming sheep ranch. That was where he really grew up, he says. In fact, he feels that experience was really responsible for his becoming an editor. His adventures in Wyoming provided him with so much raw material for writing successful high school and college essays that he developed a taste for writing.

His mechanical ingenuity turned out to be pretty handy. When the last ranch hand had been drafted. Ted had to rush him to the railroad station 30 miles away. Exactly midway one of their tires punctured, and there they were-15 miles from either place. They needed something to ignite the vulcanizer with which to patch the ailing tube, but neither of them smoked. It was then that Ted produced one of his proudest (and most timely) inventions. He did the trick with a bit of wire connected to a spark plug, a tin can and some gasoline. The resulting spark ignited the gas and the gas touced off the vulcanizer; the draftee made his train!

Some of the jobs he had to do were hard on his dignity, even if he was only 16. Like the time he had to substitute for a sheep dog. He and another herder had to move 500 quarrelsome buck sheep 35 miles in one day, four times as far as any sheep should ever be moved in a like period. All their dogs had died of coyote poison, and rabies had started a dog embargo. Ted and his companion spent an 18-hour day riding around the herd and barking furiously in imitation of the absent dogs.

Ted then came back east to finish high school and enter Harvard. He changed his mind about oil shale geology and decided to switch to chemical engineering. The fact that the school did not give a course in chemical engineering didn't disturb Ted any. He just made up his own course out of chemistry, mechanical engineering. Chem. & Met., the Chemical Engineering Catalog and Walker Lewis and McAdams.

After getting that AB degree he spent another year in Engineering School and the next four years getting broad and varied experience in the chemical industries. "I literally jumped at the chance to join Chem. & Met. in 1927. Here was my chance

to combine the two things I most thoroughly enjoyed—writing and en-

gineering."

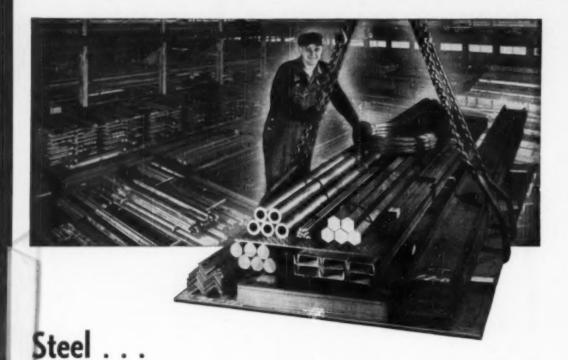
In the last 23 years Ted has had his hand in just about every type of job the magazine has done. He initiated the diagrammatic flowsheets which first appeared in 1934. One of his principal activities has been in carrying along our tradition of special engineering theme issues. The job that seemed to make the biggest splash was the May 1943 report on measurement and control of process variables. There are many demands for reprints even today, seven years later. There were more than 200 drawings in that issue and he sketched a large proportion of them at his local air-spotting post from 6 to 8 on winter mornings.

In 1935 Ted took the necessary courses and examinations to get a professional engineering license in New York. The state printed 5,000 copies of the chemical engineering examination that year. Ted used one copy, the remaining 4,999 were never used.

Ted is just about our hardest-working editor, but he has found time for a number of outside professional activities. He belongs to several societies and has been particularly active in the ASME. He helped organize the new Process Industries Division and was its secretary for many years. He helped reorganize the defunct Petroleum Division in the middle forties and was its first program and publications chairman. For the last five years he has been a member and is now chairman of the ASME Professional Divisions Committee.

After coming to Chem. & Met. Ted developed two more hobbies. Domestic architecture was one. For eight years he drew hundreds of plans and entered two architectural contests against professionals (losing both). When he finally got around to building his first house in 1936 his wife couldn't stand it more than five years. Everything was designed from the standpoint of motion study and it just gave her claustrophobia.

Ted's most beloved hobby right now is boat handling. Anything from an outboard motor up interests him, but he has owned a large cabin cruiser, and now a 30-ft. cruising sloop in his coming-and-going collection. "My eternal problem," he says, "is whether to sell or keep on sailing."



for Every Chemical Engineering Need

Shipped Quickly from Ryerson Stocks

Call Ryerson for the steel you need and you'll find we're always on the job.

Every day, companies from coast to coast that use steel in chemical processes are being expertly served by the network of thirteen great Ryerson plants. Each plant has large and diversified stocks. Each plant is equipped to accurately cut or otherwise prepare your steel to exact specifications.

Under the Ryerson simplified purchasing system you save time. One order and one invoice quickly cover a whole group of steel requirements. Specialists. whose recommendations are backed by more than a century of Ryerson steelservice experience, will gladly assist you on any problem of application or fabrication.

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sHAFTING — Cold Sn., ground & polished, etc. STRUCTURALS.—Chan-nels, angles, beams.

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PLATES — Sheared & U. M., Irland 4-Way Floor Plate.

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MACHINERY & TOOLS.

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Chemical Engineering

JULY 1950

Men, Milk and Money

At the dedication last month of the great Long Island laboratories of National Dairy, Dr. Karl T. Compton of M.I.T. was asked, "Why is a chemical engineer in charge of the research laboratory of a company concerned with dairy products?" His two-fold answer suggests both a trend and a challenge. First, the prime qualification of a modern research director is that he be a team leader, that he have essential personal characteristics as well as broad technological background. Second, it was Dr. Compton's observation that the modern food industry is becoming more and more dependent upon the unit operations and processes of chemical engineering. Therefore it is to men with broad training in this field that management is now turning for executive leadership in research.

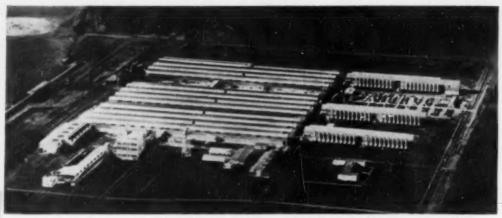
Louis Bromfield, the famous farmer-author of "Out of This Earth," was outspoken in his criticism of the tendency toward over-specialization, especially in the natural sciences. "In our times over-emphasis upon specialized research has led increasingly to the seeking of answers down certain narrow channels, while ignoring the countless variables and to the exclusion of the whole. All too often this over-specialization tends to lead into blind alleys and false assumptionsto produce laboratory and research technicians who are little more than glorified drug clerks." Harsh words, these, but they were tempered by an eloquent appeal for the Renaissance conception of the broadly educated man. "He is," said Bromfield, "the man who stands in awe of the universe and is constantly striving to penetrate deeper and deeper into a clear understanding of all the parts."

But it was Dr. Charles Glen King, scientific director of the Nutrition Foundation, who reminded us of milk and money. Return per acre in terms of food, agricultural economy and human health is greatest from the production of milk. It is our first line of defense in planning food supplies that will conserve the health of children and adults. It is a challenge to industry to use our technological resources to improve every process in its production and utilization.

Fairfield Osborn, president of the Conservation Foundation and author of "Our Plundered Planet," said that milk, with its 273 different nutritional factors, could aptly be called "the highest denominator of our foods." For too long we have neglected the socalled trace elements in our soils and the foods ultimately derived from them. Recent research has shown what appear to be parallels in plant and animal deficiency diseases, with certain pathological symptoms in man. The world's best factory for producing the anti-pernicious anemia vitamin, B-12, is in the rumen or first stomach of the cow. The spectrograph has shown us that B-12 contains an atom of cobalt, probably serving as a coordinating agent for the six complicated organic groups. This interested Mr. Osborn because 15 years ago someone had discovered that minute quantities of cobalt when applied to seemingly normal grass lands permitted the grazing of animals which otherwise would have fallen ill or died. Yet it was not until B-12 was crystallized that cobalt was recognized as one of man's essential trace elements. And it comes to our door every morning in a milk

These random notes reflect only a part of the stimulating discussion that made our day at Oakdale so pleasant and profitable. We congratulate President L. A. Van Bomel of the National Dariy Products Corporation for his vision and courage in purchasing the W. K. Vanderbilt estate and converting its luxurious facilities to a much more useful purpose. We congratulate President Lauren B. Hitchcock of the National Dairy Research Laboratories on the opportunity to apply his chemical engineering training and experience in the direction of research that can mean so much to mankind.

Didney Frihpatrick



In this aerial view of Alcoa's new reduction plant the three pot lines are at the left, the three powerhouses at the right.

Gas Makes Power for Aluminum

At its new Point Comfort works, Alcoa has 120 natural gas engines of novel design, each generating 1,000 kw. for aluminum reduction

Newest aluminum plant in the United States is the Point Comfort works of Aluminum Co. of America, situated on a 3,000-acre tract on Matagorda Bay near Port Lavaca, Tex. Although the reduction plant itself has many novel features, the one feature that is attracting the most attention is the 120,000-kw. generating plant that provides all the power needed to produce the plant's rated output of 114,000,000 lb. of aluminum per year. This plant is powered by two-cycle radial gas engines—of a brand-new type—120 of them, each rated at 1,600 hp.

These engines, built by Nordberg Mfg. Co. from designs developed jointly by Nordberg and Alcoa engineers, each have 11 cylinders of 14-in. bore and 16-in. stroke, arranged in a horizontal radial pattern about a single vertical crankshaft. Beneath the engine operating floor and directly coupled with each engine is its generator which produces 1,000 kw. d.c. at 667 volts, as well as 125 kva. a.c. at 425 volts and 25 cycles. The alternating current power is used for driving engine auxiliaries. Generators were supplied by three makers, Elliott, General Electric and Westinghouse.

There are 40 of these engines in each of three powerhouses which appear at the right in the view above. Each powerhouse serves one of the three pot lines, which occupy the

lefthand portion of the air view. Engines operate at 360 rpm., achieving a thermal efficiency of 29-30 percent. Each consumes natural gas at a rate of 13,000 cu. ft. per hr. when under load, adding up to a gas load for the plant of over 30,000,000 cu. ft. per day. Total plant output is about 2,750,000 kwh. per day, with a consumption of about 10 kwh. per lb. of aluminum produced.

One earlier aluminum plant has previously been powered by internal combusion engines operating on natural gas, the Jones Mills, Ark., plant built during the war by Alcoa for the Defense Plant Corp., and now owned and operated by Reynolds Metals That plant uses conventional engines, some of which operate on the diesel cycle, and some as spark ignition engines. The new Nordberg engine used at Point Comfort is designed to operate with slight modifications as either a dual-fuel, oil diesel or spark-ignition gas engine. In this particular installation the last named is the most economical arrangement. Except for the two plants mentioned, other aluminum reduction plants on this continent have all employed hydro power.

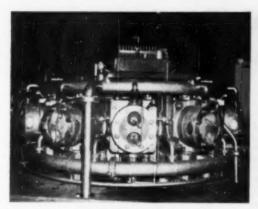
Engines are designed for easy accessibility of all parts for repairs. Circular manifolds for exhaust and scavenging air are situated on the lower floor, together with the truncated concal motor base that encloses the generator, and the motor-driven scavenging air blower. Intake and exhaust are timed by the pistons uncovering ports in the cylinder walls, so that the usual valves are not needed. Gas is admitted by cage-mounted gas valves operated by a cam on the crankshaft and located so that gas is admitted into the path of the scavenging air to insure thorough mixing. A governor controls gas admission according to the load.

Each engine-generator unit has its own control panel but in addition, each of the 40-engine powerhouses has a master control room for indicating and recording the operation of each unit. Each engine has its own 100-hp. scavenging air blower and 71-hp. generator cooling fan, as well as its own exhaust stack and dry-type airblast cooler for engine cooling water and oil, and a combustion-air washer. Aluminum is used extensively for electrical conductors, heat exchange equipment, housings and building construction.

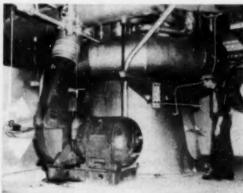
The company's gas supply is provided by a subsidiary pipeline company organized to gather the natural gas from both on- and off-shore wells and transmit it to the plant at pressures of 400-500 psig. Within the plant gas is distributed at 60 psig. entering the engines through regulators at 6 psig.



Operating floor in one of the three powerhouses, showing how the 40 radial engines and control panels are arranged. Engines each develop 1,000 hp. and drive a direct-connected generator which, with auxiliary equipment, is on the floor below.



Gas engines have 11 cylinders, 14-in. bore, 16-in. stroke. Governor, distributor, lubricator, gas valves are on top.



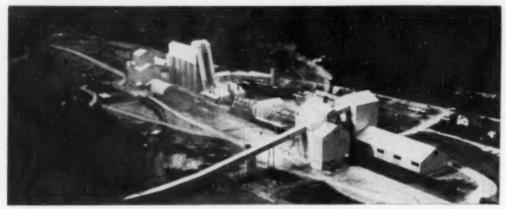
Engines are supported on a steel base housing the generator. Scavenging air blower and duct, exhaust manifold are shown.



Air-blast heat exchangers for cooling engine water and oil have 7-ft., 25-hp. fans. Exhaust stacks are $7\frac{1}{2}$ x 50 ft.



Actual control is from operating floor, but master control panels record operation of both engines and generators.



Rotary kilns like this, along with large vertical kilns, supply most of our lime needs. Kilns are located in 31 states.

Lime—An Industrial Chemical

Widely used in the process industries, its production has grown steadily. Today lime is our second largest chemical.

B. S. BOYNTON

If laymen and even some chemists and chemical engineers are asked to-day the question, "What is lime?", they will almost invariably reply that it is a "building material"—or "an ingredient of plaster"—or "the white stuff that farmers spread on their soil to grow healthier crops." Up until about 20 years ago such replies would have been substantially correct. But today lime as a basic (or industrial) chemical, enjoying the same heavy chemical status as sulphuric acid or soda ash.

This change in emphasis occurred first in 1929 when the total sales of "chemical" lime exceeded the combined building and agricultural sales for the first time. Since then, the increase in chemical sales has been steady. In 1948 (a big building year) chemical sales totaled 74 percent of all lime sold. In 1948, 4,255,403 tons of chemical lime were sold on the open market. However, it is estimated that another 2 million tons was actually consumed in 1948 as a chemical if the captive tonnages of alkali, sugar, carbide, metallurgical and other plants are included. Thus, as a chemi-

cal, lime ranks just behind sulphuric acid as the second largest chemical raw material utilized by industry, outstripping such well known basic chemicals as soda ash, caustic soda, chlorine, and alum in total consumption and shipments.

CHEMICAL MARKETS

The U. S. Bureau of Mines and the lime industry have always defined chemical lime on an end-use basis, namely consumption by manufacturing industries where this material almost invariably enters into one or more specific chemical reactions in the various stages of manufacture. These main industrial uses are:

Metallurgical—Although lime is used widely in many phases of the metallurgical field, its largest application is as a flux in purifying steel. Electric steel furnaces use lime exclusively instead of limestone to produce the special, high grade steels required for machine tools, and precision instruments. The basic open hearth also uses lime in addition to limestone, particularly in the final refining stages of the process which is known as "finishing the heat."

Several minor uses of lime in the iron and steel industry are in wire drawing, in "pig" casting and in neutralizing the acid residue after pickling steel.

In the far west lime is employed extensively in the flotation of copper, gold, and silver ores. It is commonly employed as a flux in the smelting of nickel and low carbon chrome and to absorb H_sS and SO₄ gases from copper and lead smelters.

During the first few years of World War II enormous quantities of high calcium lime were required in the manufacture of alumina via the Bayer process. Today some alumina plants are sintering largely with limestone instead of lime, but quickline is required for desilification.

Most magnesia processes use large quantities of dolomitic lime. These processes include the Dow method from natural brines, dolomitic solvay process, and ferro-silicon. One other, the Dow seawater process, requires high calcium lime.

Pulp and Paper—Lime's function in pulp and paper manufacturing is multifarious. However, its largest application is probably as a causticizing agent in the sulphate and soda processes where the waste sodium carbonate solution is recovered and reacted with high calcium lime to generate caustic soda for reuse in the process (Na₂CO₃ + CaO + H₂O = CaCO₃ +

R. S. BOYNTON is general manager of the National Lime Association, Washington, D. C.

2NaOH). Most large soda and sulphate plants now recover 90-92 percent of the lime by drying the waste calcium carbonate mud, then pelletizing it before calcination in rotary kilns. The "make-up" lime required is purchased "fresh" from commercial lime plants.

In the preparation of the calcium bisulphite liquor required in the sulphate process some small plants still use dolomitic quicklime instead of limestone. Here milk-of-lime is reacted with sulphur dioxide forming a calcium magnesium bisulphite liquor, the key material used in the sulphite process. Manufacture of strawboard has always required large quantities of lime. The straw is digested to pulp by cooking it with milk-of-lime and steam in large rotary digesters. Most pulp plants prepare their own bleach liquor through the reaction of chlorine and milk-of-lime which produces calcium hypochlorite.

Sanitation-The largest use of lime in the sanitation field is for the purification and treatment of water in municipalities, industries, and railroads. The oldest method of softening water is the lime or lime-soda method. Here, lime is used to remove temporary hardness (magnesium and calcium bicarbonates) whereas the soda ash is required to remove the permanent hardness (sulphates). Turbid waters are generally treated with coagulants like alum or iron salts in combination with line which serve to clarify these waters for potable purposes. Excess lime treatment has been employed successfully in purifying water in lieu of chlorine through maintaining a high pH. The aggressive carbon dioxide in corrosive waters is commonly neutralized with lime. Some plants will use lime primarily to precipitate iron, manganese, or fluorides from their water supplies. Quite recently dolomitic lime has found increased use in the removal of silica from boiler feed waters.

Municipal sewage plants commonly use lime for pH control in their sludge digesters, to neutralize acidic trade wastes which are collected in their system, and oceasionally to precipitate suspended solids from effluents.

Industrial Trade Waste Treatment—The recent development and enforcement of federal, state, and municipal laws and regulations designed to arrest stream pollution by industries has focused attention on lime as a means of chemical treatment. Many plants will have to resort to lime for chemical neutralization and precipitation.

Chemical Manufacture - Largest use for lime in the manufacture of

chemicals is in the alkali industry where a high calcium line is an essential material in the ammonia soda process for the manufacture of soda ash and caustic soda. There are no lime shipments to this industry except in possible emergencies since without exception all alkali plants burn their own lime. The economics of the Solvay Process depends on cheap CO, which is required in the process. As a result, in burning their own lime the alkali plants recover the CO, as a coproduct with lime.

The biggest shipments of lime to the chemical industry are for the manufacture of calcium carbide. High calcium lime and coke are fused together at high temperatures in an electric furnace (CaO + 3C = CaC_x + CO) with calcium carbide, the country's chief source of acetylene, resulting. It requires approximately one ton of lime to produce a ton of

calcium carbide.

Lime is also required in the manufacture of many other industrial and fine chemicals and pharmaceuticals. Magnesium oxide and hydroxide are produced from lime by several different processes; high calcium lime is required in the manufacture of calcium phosphates (mono, di, and tri), chrome chemicals, citric acid, calcium cyanamid and cyanide, the recovery of ammonia from coke-oven areas, acetate of lime, chloride of lime; precipitated calcium carbonate and high test calcium hypochlorites and ethylene glycol.

Glass—Of all the raw materials entering into glass, lime and limestone rank third. A common glass batch is composed of 70 parts sand, 18 parts soda ash, and 12 parts lime, this will vary for different types of glass. Some glass plants prefer to use limestone and others lime. On an equivalent CaO basis the relative consumption of lime and limestone appear to be about

the same.

Insecticides—Lime has long been used as an ingredient in agricultural insecticides and sprays. It reacts with arsenic acid to form calcium arsenate and generally additional free hydrated lime is added as a carrier for dusting crops. It is commonly employed as a carrier (or diluent) with Bordeaux mixture, lead arsenate, Paris green, and other insecticides.

Lime-sulphur sprays (calcium polysulphides) are made by heating sulphur and milk-of-lime. Lime also is mixed with sulphur in a dry state and is used for dusting crops as a fungi-

cide.

Leather Tanning—Tanneries have always employed a lime suspension for plamping and dehairing hides. As a depilatory, lime is often used with small amounts of "sharpening" agents. like sodium sulphide or arsenic sulphide.

Other Uses-The number of uses of chemical lime are legion. Some of the relatively minor uses of this product are in the manufacture of sand-lime brick where 5-8 percent high calcium hydrated lime and the remainder fine grained sand are autoclaved with steam under pressure to form a true, stable monocalcium silicate. Insulation materials are also made with lime and diatomaceous earth. Lime is used extensively in both cane and beet sugar. However most sugar mills produce their own lime as they also require low cost CO, in the process.

It is used in the manufacture of cement and cold water paints and varnish; in silica bricks (refractory); lubricating grease; causticizing in soap plants; conditioning drilling muds in oil well drilling; in petroleum refining; manufacture of satin white, iron oxide, and antimony oxide pigments; animal glue and gelatin; utility gas purification; and numerous other special

uses

TYPES OF CHEMICAL LIMES

Just as sulphuric acid has always been the lowest cost acid available so is lime the lowest cost alkali. Chemists and chemical engineers are recognizing this fact more and more in using lime for pH control in an increasing number of applications. Another factor covering growth of chemical lime is that the quality and uniformity of lime have steadily improved.

Today, many chemists are employed by the industry and chemical control has become an important consideration in lime burning. Well equipped and staffed laboratories, are not uncommon today. But 40 years ago they were unknown. In addition, many rotary and vertical kilns are now operated largely or entirely by chemical control instruments. Lime plants are selecting their limestone and stone deposits with greater care. As a result limes of higher available CaO or combined CaO + MgO content with greater reactivity and uniformity are now produced.

The two industry products are quicklime (CaO) and hydrated lime (Ca(OH)_n). The quicklime is sold as lump lime (from vertical kilns) of 8-in. to 6-in. top size; as pebble lime in various sizes ranging from 1½ in. to ½ in., and as pulverized or powdered quicklime. It is shipped in bulk, preferably in hopper bottom cars and in bags. Hydrate is commercially produced as a free flowing, extremely

fine white powder. For all practical purposes most hydrates are completely hydrated and through air separation and milling virtually all calcium carbonate core and coarse particles are removed. The usual degree of fineness is about 96 percent passing a 325-mesh sieve. However, by adjusting the hydration process it is possible to produce hydrate of even smaller particle size. Lime particles have been measured as small as 0.20 micron. Some plants are equipped to ship hydrate in bulk, but most shipments are made in bags because of the greater ease in handling and storing.

Basically there are three different types of lime: (1) high calcium where the MgO content does not exceed 3 percent (this is a liberal definition since the MgO of most high calcium limes today will not exceed I percent); (2) magnesium lime where the MgO content ranges between 5-15 percent; (3) dolomitic lime where the MgO content ranges between 30-40 percent (a true dolomitic lime is generally considered to have about a 60 to 40 ratio of calcium and magnesium oxide). Type (2) has virtually disappeared in this country since it contains too much MgO to be of value in many of the chemical markets, and lacks sufficient MgO to qualify as a good dolomitic building

Generally high calcium lime is preferred. It is more widely used in most chemical fields. Dolomitic lime occupies a similar role of superiority in the building field. Nevertheless, there is a definite preference for dolomitic lime in a number of industries, such as in glass, sulphite pulp plants, magnesia products, and silica removal from boiler feed waters. Many users of agricultural "spray" hydrated (insecticides) prefer dolomitic. However, recently with general interest centered on lime as a neutralizing agent in the treatment of acidic wastes, dolomitic lime has developed increased interest as a chemical lime in view of its greater basicity than high calcium lime. From a neutralizing standpoint, 100 tons of dolomitic quicklime and hydrate are equivalent to 118 and 129 tons respectively of high calcium quicklime and hydrate. Because of this superiority in basicity and the fact that the resulting sludge volume is smaller, several large chemical process plants have selected dolomitic over high calcium lime in spite of its obvious disadvantage of slower reactivity and filterability. This does not mean that high calcium is "out of the picture," but simply that both limes have a definite place in neutralization. The final determination will vary from plant to plant. This discussion on dolomitic lime is simply to correct the fallacious thinking of some technical men that all dolomitic limes are impure and that MgO is a poison in all chemical processes. Actually some dolomitic limes from northwest Ohio in particular are as pure chemically as the best high calcium limes from the standpoint of silica, alumina, and R,O, content.

Many chemical process industries have their own complete or partial specifications on lime. ASTM Commitee C-7 on Lime has written specifications for many chemical uses of lime as well as methods of chemical analyses in determining available CaO, total oxides, and the various impuri-

RESEARCH

Some lime companies have carried on research designed to improve their own products and plant efficiencies, but the commercial lime plants have done very little on fundamental research or research for new chemical markets. For industry-wide research of this kind the commercial lime plants today are depending largely on the National Lime Association, which has been concentrating its activities on fundamental and applied research for the past four years.

One long range association program is a fundamental study of lime at M.I.T. Particle size, surface area, and porosity determinations have been made. Currently a wide range of different kiln feed (limestones) is being calcined in a laboratory rotary kiln. Through use of the differential thermal analyzer studies are being made on how the impurities, calcining temperatures and lengths of burning time affect the final physical and chemical characteristics of the lime. Results of these tests are being compared with similar tests on lime made experimentally from pure calcite. This research may eventually answer the question of why two limestones of almost identical physical and chemical properties should possess such entirely different rates of reactivity and settling qualities when calcined and subsequently hydrated.

In applied research the National Lime Association is sponsoring research at Rutgers on sewage and trade waste treatment. Research on pickle liquor and canning wastes have been completed recently. Currently fundamental research on lime neutralization of various types of acid wastes is being conducted.

The association is carrying on re-

search at Purdue University on a new, promising non-chemical use of lime in road stabilization. Small percentages of lime when mixed with certain plastic clay soils and base course materials have developed unusual strength and stability on roads in Texas through what is believed largely pozzolanic action. It is expected that this study will soon reveal lime's place in this field.

MARKET DEVELOPMENT

Traditionally the lime industry has been conservative and unaggressive; its interest has been more on production than sales. It has relied on the low cost and all-round versatility of its products to develop the many new chemical markets that have materialized in the past 20 years. Promotional and development work by the lime companies themselves has not been particularly active and selling has largely been on a commodity basis. Lately a few companies have embarked on a creative sales program in the industrial waste field. Pilot plants have been built by the Marblehead Lime Co., Chicago, and Warner Co., Philadelphia, enabling these companies to perform considerable development research on lime neutralization in this new chemical field, and at the same time supply valuable technical assistance to actual and prospective customers. However, for the most part virtually the only industry-wide development work has been a modest amount performed again by the National Lime Association. Besides conducting research the Association publishes promotional and technical bulletins which are distributed widely.

LIME PRODUCERS

Originally, most lime plants were small, family-owned manufacturing companies. Even today there are many such family-owned companies which have been handed down from father to son for generations. However, a number of these companies have grown considerably in the past generation. An example is Mississippi Lime Co. of Ste. Genevieve, Mo., which operated about 15 to 20 low capacity vertical kilns in 1930. Now this company also operates seven large capacity rotary kilns plus two other good sized vertical kiln plants which they recently acquired. However, even the biggest commercial lime plants will only compare in size to the smaller chemical manufacturers. This can be readily appreciated when the total annual lime sales for the industry amount to only \$58,000,000.

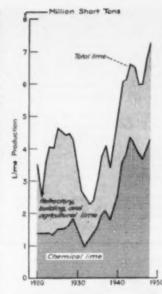
In 1909 there were over 1,000 in-

dependent lime plants. Today the National Lime Association estimates that there are only 118 of commercial significance. However, including all burned lime sales the 118 plants today produce about 110 percent more lime than in 1909. This indicates that while lime plants have dwindled in number, their average size has simultaneously increased at even a greater rate.

The principal reason for this drastic reduction of lime plants is not due to absorption by large holding companies. It is due to the fact that the business has become predicated on a very small margin of profit as a result of highly competitive conditions over the years, and volume is essential in most cases for a profitable operation. The exceptions to this premise are largely cases of small lime plants that are located in isolated sections of the country with the protection afforded by freight rates and sparse markets. The low average profits existing in the industry and the high fatality rate of small lime plants have discouraged new risk capital in recent years. As late as 1925 a person could enter the business on a modest investment of \$20,000. Now at least \$500,000 would be required and many lime manufacturers consider the minimum investment necessary to be at least \$1,000,000. Added to this is the fact that since the demise of the OPA. lime prices have only advanced on an average of about 30 percent while construction costs have risen 75 to 125 percent. The cost of plant amortization, as a result, to most investors appears insurmountable. Naturally, the steady increasing labor costs since 1945 have worked more to the detrement of the small vertical kiln plants than to the more mechanized rotary and large capacity vertical kiln plants. In the past year, two well-established vertical kiln lime plants have abandoned the business permanently be-cause of lack of profit.

CAPTIVE PRODUCTION

There is probably no chemical, excepting only sulphuric acid, which has quite as much captive production as the lime industry. A large amount of this production emanates from the alkali and sugar industries which is understandable since the economics of their processes are predicated on inexpensive CO_b, the coproduct of lime manufacture. The other captive producers are scattered. They include such companies as Union Carbon and Carbide, Sheffield, Jones & Laughlin and Bethlehem Steel, Johns-Manville Co., Dow Chemical Co., Aluminum



Corp. of America, to a limited extent International Paper Co., and most lately the Southern Cement Co. All of these companies are enormous consumers of lime. Many of these concerns do not produce all of their own requirements and are forced to purchase open-market lime as well. The principal reason for this captive production is largely due to fear that their total requirements cannot be filled by the lime industry. A few were not satisfied with the quality of the commercial lime available. In one case it was due to idle kiln capacity in their plant. However, captive lime production has not always been successful. In recent years, two producers discontinued manufacture in favor of open-market lime. The correlation in locating deposits of suitable limestone with the burning plant and consuming points is becoming more and more difficult because of the growing scarcity of quality stone and increasing freight rates. Even for those large corporations that prefer integrated operations, it does not offer an attractive investment at present production costs and prices.

WIDESPREAD PRODUCTION

Lime is being produced in 31 of the 48 states. While the increases in freight rates have added to its net cost, they have not affected its consumption as a whole since the freight costs of other competitive alkalis have increased similarly. A factor in the growth of lime as a chemical has undoubtedly been due to its plentiful supply (except for wars) and widespread availability.

Most lime companies quarry their own stone; however, a few successful plants that are situated on the Great Lakes have purchased their stone from the largest limestone quarrying operation in the world, the plant of Michigan Limestone and Chemical Co. at Calcite, Mich., and to a lesser extent from the Inland Lime and Stone Co. in the Upper Peninsula of Michigan. Here limestone is shipped in bulk by water similar to iron ore. Shipment by rail would make the cost prohibitive.

Although most of the companies obtain their stone from open quarries, there are a number of plants that mine their stone, notably in the Belle-fonte, Pa., and Ste. Genevieve, Mo., districts. At Bellefonte, the stope method of mining at different levels is employed down to about 800 ft. in contrast with Ste. Genevieve where mining is done on one level at less depth. The deepest mine is about 2,250 ft. and is operated by a captive plant, the Pittsburgh Plate Glass Co. (Columbia Chemicals Div.) at Barberton, Ohio.

Two trends in extracting limestone have improved the quality of lime and lowered production costs. They are: (1) Use of trucks in hauling stone from the quarry to the primary crusher and (2) more extensive use of stone classifying equipment which enables a manufacturer to screen his stone more carefully so that in one rotary kiln he may burn for example, 1-in. stone and in another kiln 1-in. stone. This uniformity in size gives more uniform lime. In view of the many different ways of obtaining stone, the cost of kiln feed stone varies greatly.

LIME BURNING PLANTS

There are many different types of kilns in operation today. The old fashioned pot kilns and mixed feed kilns are still in existence, but are generally regarded as passé though a few plants are still able to operate them profitably. With the emphasis on greater capacity more interest has been focused on large capacity rotary and vertical kilns. Many plants formerly operating standard-low capacity vertical kilns of 10 tons capacity per day have converted these same kilns into much greater capacity kilns of 25 to 50 tons per day at considerable investment. Most of these conversions are called the "Azbe gas-fired kiln," and they have been successful in reducing costs.

Since the war, two new types of kilns have appeared. One is the Fluo-Solids kiln which the New England Lime Co. operates successfully at Adams, Mass.; the other is the Ellernan kiln, which is being operated successfully at several plants on a small scale. The Fluo-Solids kiln is based on fluidization (see Chemical Engineering Dec. 1947, p.112) and is featured by its extremely low fuel ratio and high capacity but its use is largely limited to certain types of soft limestone. The Ellernan kiln is featured by its ability to burn small stone low capacity producing units of about 12 tons per day, and the use of oil or gas as fuel.

Naturally, the largest capacity kiln is the rotary, but also requires the greatest investment. Some rotary kilns are known to produce as much as 300

tons per day. Because of the mechanized nature of the operation, large rotary plants can operate at the lowest unit labor cost. However, their fuel costs are higher than efficient vertical kilns. Rotary kilns of over 400 ft. in length are currently in operation. The diameter of most recent kilns ranges between 8 ft to

Coal and wood, the two traditional fuels for lime burning, have been replaced to a large extent by oil and natural gas. In the far west, oil is used exclusively while natural gas has been largely utilized in the south, southwest, and Mississippi valley section of the middle west. Many lime plants in the east and middle west operate producer gas plants. The chronic, unsettled coal supply situ-ation has been a major problem for

those plants using coal in recent years with considerable production losses resulting.

Chemical Lime Shipments 1948

Uses Steel (flux) Puip and paper Calcium carbide and cyanamide Water purification Glass Non-ferrous metallurgy Sewage and wastes treatment Insecticides and fungicides. Leather tunning Petroleum refining Sand-lime and stilca brick. Stock feed ma purification Stock feed map purification Sugar refining Calcium carbonate (precip.) Gelatin and giue Wire drawing	Net Tons 1,131,098 697,834 475,287 225,866 311,134 191,117 92,037 88,329 38,323 24,510 20,318 19,429 18,685
Gelatin and glue	19,429 18,585 14,073 164,187 238,514
TOTAL	4,255,403

· Excludes captive use.



To Dow, barges mean cheap transportation, opening of far-away markets.

How to Move Muriatic by Barge

Handling and transporting large quantities of hydrochloric acid is a tricky business. In recent months considerable information has been given concerning the method of shipping bulk hydrochloric acid by barge. Since late in 1947 Dow has been using large quantities of the acid from Freeport, Tex., to Cincinnati, Ohio.

Now details of their operation can be made public. Dow is now operating a fleet of nine barges which can transport about 31 million gallons per year of hydrochloric acid from Freeport to Cincinnati. The fleet consists of four hopper-type cargo barges fitted with rubber-lined tanks, plus five new barges designed by Dow engineers in collaboration with naval

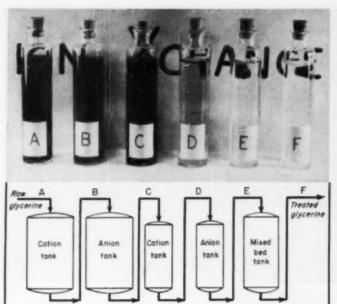
architects of Dravo Corp., Pittsburgh. Each of the new 195-ft. barges is equipped with four tanks-each tank has a 12-ft. diameter and is 73 ft. long. These are the largest rubberlined tanks ever fabricated for use on a barge. For better efficiency domes of the tanks are located in a central point in the barge and protrude through a working platform that is sloped outboard to provide drainage for spilled acids. Dow loads its barges from a dock that carries a 6-in. rubberlined steel pipe extending to the storage tanks. To this pipe is attached a small 4-in. flexible acid-resistant Saran hose. The 4-in. line is connected to the 6-in. common header pipe on the barge during loading the flow

into the individual tank is controlled by valves within the barge. A twoman crew loads the barge in about 8 hours with 233,600 gal. (about 1,000 tons) of 22 Be acid. After the barge has been loaded a specification analysis is made. Another is made in Cincinnati.

Dow's small tug, Edco, tows the barges from Freeport to Galveston where a contract carrier picks them up for a trip through the Inter-coastal waterway to the Mississippi river. There another barge line takes them to Cincinnati. Unloading procedure requires the use of a special 4-in. valve centrifugal acid pump. After the pump is started air is forced into the pump with the excess pressure vent to help suction. Air is shut off when full suction has been obtained. There is a sump at the bottom of each tank permitting the tank to be stripped of a batch of cargo. The Cincinnati terminal has a 41 million gallon storage capacity tank.

An average time of 60 days is required for the 3,500-mile round trip. This includes delays in unloading the barges. In addition to the savings resulting from economical river shipping rates, Dow's traffic department explains that a substantial amount of time has been saved loading the barges. It takes 22 hours to load tank cars of the same quantity of acid that can be loaded into a barge in eight hours. Moreover in loading tank cars with the acid, pipeline connections have to be made for every 8,000-gal. car, while only one connection is required to load 233,600 gal, into one barge. This cuts down the number of chances for spilling and saves wear

and tear on equipment.



A three-stage ion exchange unit of two cation-anion stages and one mixed bed stage (as in diagram) reduced the color of crude glycerine from opaque to water-white as shown by reference letters on samples and at corresponding points on flow diagram.

Purifying Crude Glycerine By Ion Exchange

Ion exchange can eliminate distillation, although not evaporation, in the purification of crude glycerine. In many cases it is also cheaper

F. H. KAHLER

Ion exchange has made an important place for itself in the removal of dissolved, ionizable solids from water. Now it is also going into a variety of purification operations on materials other than water. One of these, now being installed by three glycerine producers, is the removal of ionized solids (ash), color- and odor-producing materials from dilute aqueous glycerine solutions.

Ion exchange for purifying glycerine

solutions has several advantages compared with earlier methods: (1) It gives a more uniform product, all of C.P. quality, and at lower operating cost in most cases; (2) its product is more stable to light; (3) no foots are produced, since the purified solution can be concentrated without loss. The new process offers the further advantage for new construction of lower capital investment. As an addition to present capacity it means a better product of greater uniformity and higher quality.

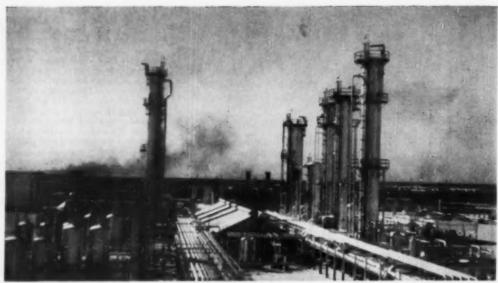
In removing ionizable materials from aqueous solutions of non-ionized

material such as glycerine, the solution is passed in series through a cation exchanger and an anion exchanger, or through a mixed bed of cation and anion exchanger, or through a combination of these. Early passage through a single pair of cation exchanger and anion exchanger beds removes 90 percent or more of the ionizable materials in the solution. Thus the first passage will leave 10 percent or less, while the second passage will leave 1 percent or less of the original ionizable material present in the untreated solution. How much ionizable material is initially present, and what concentration can be tolerated in the final solution, determines whether a single pass is enough, or whether a second or perhaps a third pass will be needed. Often additional color-removing material is used also.

Ion exchange has been successful in purifying a wide variety of glycerine-bearing solutions, ranging from waste sweetwater with 3-5 percent glycerine, through normal sweetwaters with 8-15 percent, to saponification crudes and soap lye crudes in which the ash content runs as high as 15 percent. With ion exchange, any of these materials will produce a dilute glycerine which can be concentrated to a C.P. product without distillation. The diagram presented here shows a simplified schematic flowsheet of a three-pass unit for treating crude glycerine. It consists of two cation-anion passes and a mixed bed unit. The reference letters refer to the sample bottles above and show the appearance of the glycerine at each stage.

Operating costs for ion exchange treatment include regenerant chemicals-sulphuric acid and caustic soda —as well as resin and equipment amortization, labor and evaporation (crudes must be diluted before ion exchange). Cost of regenerant chemicals is directly proportional to the ionized solids content of the raw material. Cost per pound of glycerine conse-quently depends on both the ash content and the glycerine content of the raw material. Regenerant chemicals for treating a sweetwater with 10 percent glycerine by weight, containing 0.5 percent ionizable solids, cost about 0.25 cents per pound of 95 percent glycerine produced. Resin and equipment amortization depend on the type of material being treated, while labor and evaporation costs depend on fuel supply and other local conditions. In general, however, ion exchange is cheaper than distillation for crudes with less than 10 percent of ionized solids, and for sweetwaters with less than 2 percent of ionized materials.

F. H. Kahler, author of this article, is in charge of sales for the Illinois Water Treatment Co., Rockford, Ill.



Sid Richardson's new natural gasoline unit gets big yields of pure hydrocarbons by processing West Texas natural gas.

Hydrocarbons from Natural Gas

Proper processing of pipeline gas shows novel chemical engineering methods and produces valuable raw materials for chemical manufacture.

H. H. JONES and JOHN T. COX, Jr.

FOLDOUT FLOWSHEET To follow this natural gasoline process more easily, unfold the special Pictured Flowsheet on page 178. You may want to keep it before you as you read.

Much has been written about the great chemical frontier of the Southwest and the emphasis has been laid on the Gulf Coast of the area. However, Texas is a very large State and has within its confines other great resources in addition to those found on the Coast. The West Texas area running up to the New Mexico border has such tremendous oil and gas reserves that it staggers the imagination

of even hardened Texans. The latest discovery, the Scurry County Reef, has a potential even greater than that awesome flood of petroleum of 1930's

West Texas gas fields will supply the major part of the demand of the California pipelines and the anticipated completion of construction of these great lines is in sight. They will take several hundred million cubic feet a day and the gas has to be carefully prepared for the 1,500 mile transmission to California. Hydrocarbons and sulphur compounds being extracted, or available for extraction, from these large volumes of gas total many tons per day of potential chemical feed stock.

A 50 YEAR SUPPLY

Gas comes from the underground reservoirs in these areas containing much ethane, saturated with propane, butanes, and pentanes. New reservoirs are being discovered every day, and presently producing fields are contracted to the contract of the contract o

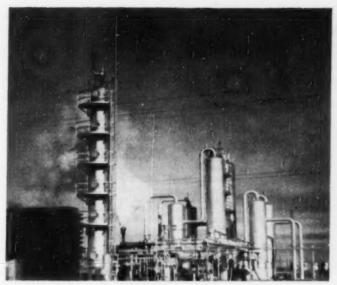
servatively calculated to be productive from 30 to 50 years. A typical analysis is:

303 03-			Mol C
Methane			81.98
Ethane .			9.51
Propane Butanes			1.92
Pentanes	and a	bove.	1.45
CO2			0.26
HaS			0.26

It is necessary from both economic and operational viewpoints to remove the heavier hydrocarbons from the gas, as well as to have it "sweetened" by H.S removal before it enters the pipelines. This brings into the picture the natural gasoline plant, one that to the chemical engineer is essentially a chemical raw-rulerial producer.

The classical natural gasoline or "distillate" plant has been known for many years. In it raw gas is bubbled through a light petroleum oil which absorbs the higher-homolog constituents and then the oil is stripped of this burden, to be recirculated to the absorber tower. The products of such separation are the basis for both light

H. H. Jones is chief engineer of Sid Richardson Gasoline Co., Fort Worth, Tex. John T. Cox, Jr., formerly deputy director of the Office of Rubber Reserve, is a consulting chemical engineer in Washington, D. C.



Stripped gas goes to customer who removes H_sS and water, pumps it to pipeline.

fractions for natural gasoline blending, and a huge bottled-gas industry for industrial and domestic heating in the form of LPG (liquefied petroleum gas). These older-type plants dot the countryside in Texas where they have contributed very largely to the climination of the wasteful flaring of the residual gas of the oil fields.

Many of the older plants besides producing natural gasoline for motor fuel blending, also make a mixture of hydrocarbons that easily meets the requirements of the LPG industry. The chemical industry requirements, however, require sharper fractionation of individual hydrocarbon compounds for higher purity. Newer plant designs are accomplishing this and are also recovering higher percentages of the total hydrocarbon originally present in gas. This makes for a better overall economy and gives opportunity for the chemical industry by producing large quantities of almost pure hydrocarbons. Recently, large quantities of hydrogen sulphide have appeared as a byproduct chemical, and one from which sulphur may be extracted for acid manufacture or other sulphur compounds. This sulphur is competitive with naturally mined sulphur. An outstanding example of the new type "gasoline" plant proc-essing gas is that of Sid Richardson Gasoline Co. near Kermit, Tex.

This new Sid Richardson gasoline plant has been designed for a 75 percent recovery of propane and a 98 percent recovery of butane and heavier homologs from the field gas. At appropriate points in the system, ethanerich fractions also are available for further processing. Pentanes and other light gasoline fractions are also separated, ready for further purification as needed. This Kermit plant contains several engineering features that are of great significance for chemical engineers both inside and outside the petroleum industry.

On first inspection the beauty of the plant is apparent. The symmetry of lay-out has been planned to enhance safe, efficient operation. The striking first impression is acentuated by the extensive use of polished corngated aluminum sheet for tower and pipe covering. Beauty gained is a by-product of practical considerations. The life of this type of covering seems perpetual; and the surface maintenance costs for equipment so covered are practically zero.

KEYSTONE SUPPLIES FEED

This plant receives gas of the typical analysis from the Keystone field which gas is produced from seven underground reservoirs at different depths. Some of the gas comes into the plant at 600 psi., but a larger quantity comes in at lower pressure, some at only 1 psi. This low-pressure gas is first compressed in three stages to 600 psi. to join the stream of high-pressure field gas entering the base of the absorbers. As the present time

Plant Highlights

I Care in design has achieved a flexible and balanced operation. This enables the plant to automatically float on the gas lines with a variable volume of gas supply without appreciable loss of efficiency. This is particularly useful in this area, since allowable petroleum production is varied from month to month by State regulatory authorities. If the allowable petroleum production goes down, the gas volume is affected in the same manner. But this plant operates efficiently even under such a wide variety of conditions.

2 With an eye to future use of its products by the chemical industry, this plant has been designed to give very accurate cuts of the high homologs and the natural-gasoline fractions. This is being achieved through very exact temperature and pressure control in the fractionation sections.

3 Exact balance of utility requirements and complete independence as far as electric power, makeup water, steam and fuel gas

is concerned.

4 Unusually complete automatic control of a continuous unit brings manpower requirements to a very low level. This large plant has an operating staff of about 50, which includes three shifts of operators, all administrative, technical, and maintenance personnel.

5 Application of the divided compartmental plate technique for heat extraction or heat addition gives, in effect, multicolumn per-

formance in one vessel.

6 Pure propane is the refrigeration medium in the refrigeration cycle. Propane is almost as efficient as ammonia thermodynamically and is much cheaper for initial charge and makeup.

7 Safety for operating personnel and protection of equipment is carefully considered in each design and construction step. Besides conventional fire-fighting equipment, many proven appliances are installed to automatically shut down equipment in cases of over-pressure or excessive temperature.

8 Attractive design has been achieved with no sacrifice of engineering efficiency. Using the most modern type of heat insulation covering, the designers have combined utility and beauty. This design represents good publicity.

there are 40,000,000 Standard Cubic Feet of low-pressure gas and 15,000,-000 of high-pressure gas being proc-

essed daily.

The absorber towers are 70 ft. high, containing 22 trays designed to operate at 600 psi. Absorber oil is delivered to the towers by four 330 gpm. centrifugal pumps driven by 250 h.p. steam turbines. The oil enters the tower on the top tray and is partially cooled across two trays by the rising gas leaving the top of the tray of two compartments run in series. There the oil is taken from the first compartment at 90 deg. F. through a chiller (refrigerated by propane) and then returned to the other compartment at 50 deg. F. This cooling process is repeated in the same manner on the eighth tray. Each of the two towers thus has two intertray chillers that use a total of 300 h.p. for propane compression to provide refrigeration. This two-stage refrigeration of the absorber oil results in extremely efficient stripping of the gas, so that the plant has exceeded design capacity in both throughput and recovery.

PASS GAS TO PIPELINE

The stripped gas from the top of the absorber towers is delivered to the pipeline customer. He removes the hydrogen sulfide by typical diethanolamine treatment. The gas is also de-hydrated with diethylene glycol and is then pumped into the long distance transmission lines.

The rich oil that comes from the bottom of the absorbers is at about 80 deg. F. and under a pressure of nearly 600 psi. It contains besides the desirable hydrocarbon product gasolines, a large amount of methane. As this pressure is reduced to 385 psi. "fat-oil" flash tank, a large part of this dissolved methane comes out of solution and is compressed back

into the pipeline supply.

Since it is desirable to eliminate ethane also at this point, the oil is passed from the flash tank through a 27-plate reabsorber column, operating at about 200 psi., with a bottom temperature of 100 deg. F. To speed ethane elimination, the oil is taken from the eleventh trav in this column and is bypassed through an external reboiler. The fat-oil at the bottom outlet of the tower is said to be "stabilized" and is ready for the true stripping still. This reabsorber also receives recycle vapor streams into the bottom, and during the passage of these vapors upward, recovers desirable constituents of propane and heavier.

The stripping still is a 10 by 62-ft. cylindrical vessel with 20 trays. It is fed at the twelfth tray with the fatoil, the temperature of which has been raised to 350 deg. F. by a heat exchange previous to entering the tower. The fat-oil is joined at this point with an additional stream of pre-heated hydrocarbons that have accumulated in the separaters or knock-out drums during the initial compression. It is to be noted that this additional stream also has gone through successive stages of decompression to eliminate methane and ethane; and it enters the tower at the prescribed 200 psi. set by the main stream of fat-oil.

Entering the twelfth tray at a temperature of 350 deg. F., the major part of the 'at-oil's hydrocarbon burden flashes of and dephlegmates up through eight trays to the overhead. The partially stripped oil drops down the tower onto the tenth tray. This is divided into two compartments: from the first, the oil is bypassed through a gas-fired rich-oil tubular heating furnace, and then returned to the companion compartment at the elevated temperature of 500 deg. F. Turbine exhaust steam is fed into the bottom of the still and during its ascent helps strip the gasolines from the descending absorber oil in the

As the stripped oil leaves the base of the tower, the sensible heat is recovered by incoming tower streams so that the lean oil cools to 145 deg. F. before it is cooled by water sprayed coils to 90 deg. F. This cooled oil is the lean oil oil pumped into the absorbers. The overhead vapors and stripping steam from the still passes first through air-cooled finned tube coolers, then through separate water sprayed cooling coils and then to propane refrigerated condensers, leaving finally at 50 deg. F. and 100 psig. Reflux is taken intermediately from this stream to provide the proper ratio for tower equilibrium. Any uncondensed vapors from the propane refrigerated condenser are recom-pressed and returned to the 200 psi. primary column for re-absorption of the desirable hydrocarbon components with the unwanted methane and ethane going overhead for recycle to the absorber and hence to the pipe-

FRACTIONATE THE OVERHEAD

The total liquid hydrocarbon (overhead) product from the stripping still is now ready for fractionation. It contains small residual amounts of methane and ethane and these are removed in a conventional de-ethanizer column, the overhead vapor of which contains about 71 percent methane and ethane and 29 percent propane. These vapors are refrigerated to 70 deg. F. which liquefies much of the propane at this pressure to provide reflux for the tower. Bottoms from the de-ethanizer pass to a de-butanizer column, the overhead of which is a mixture of propune and butane. The bottom is normal natural gasoline, containing the pentanes and heavier hydrocarbons. The de-butanizer overhead passes to the de-propanizer column where propane is taken off overhead and the bottoms may be taken off either as butane or lpg mixture, determine by market demand.

All of the liquid products are treated for complete hydrogen sulphide removal and partial mercaptan removal by caustic washing and then they are given a further treatment with cuprous chloride for mercaptan and thiophene conversion to disulphides, which are non-corrosive. This plant also has a complete unit for the regeneration of caustic to remove and recover mercaptans absorbed therein.

KEEP WATER DOWN

Water consumption is held to a relatively small volume by the use of air-cooled, finned-tube condensers wherever stream temperatures are high enough to make their use practical. All of the compressor engine jacket water is cooled in this manner, and the still overhead gasoline vapors are pre-cooled before entering the refrigerating condensers. Fresh makeup water supplied by the plant's own 280-ft. deep water wells is treated under rigorous chemical control.

Steam at 400 psig. and 675 deg. F. is provided by two watertube boilers each of 42,000 lb. capacity per hour, one boiler being a standby unit. The steam demand is so well balanced that no excess exhaust has to be condensed. All large pumps are turbine driven and exhaust is used for process steam in various parts of the plant for re-

boiling, stripping, etc.

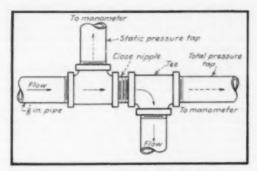
Gas compression, vapor recompression and propane refrigeration uses a total of 15,600 horsepower supplied by 13-1,200 horsepower right angle, direct connected, two-cycle gas burning engines. The plant makes is own electricity with four 300 kw., 60 cycle, 440 v. generators driven by four-cycle

gas burning engines.

This plant is typical of the high grade of chemical engineering that should now go into natural-gasoline plants today. It also demonstrates some new features of technology that chemical engineers from other industries can well afford to study.

The Plant Notebook

THEODORE R. OLIVE, Senior Associate Editor



How to Measure Flow by Impact With Ordinary Pipe Fittings

MELVIN NORD, Associate Professor of Chemical Engineering, Wavne University, Detroit, Mich.

* May Contest Prize Winner

One of the simplest methods of measuring fluid flow rates is by determining the impact pressure of the fluid. This is ordinarily accomplished by means of a Pitot tube, i.e., by a tube inserted into the flowing stream in a direction parallel to the flow of the fluid. The impact pressure is the difference between the pressure exerted by the fluid in the Pitot tube and the static pressure exerted by the fluid. The latter is determined in the usual manner by measuring the pressure in a tap which is perpendicular to the flow of the fluid. However, the Pitot tube method has several well-known disadvantages: (1) It samples only a small portion of the stream, thus determining the velocity at that point, but not the average velocity over the entire cross-section of the stream. A velocity traverse across the stream is generally necessary to overcome this difficulty. (2) Owing to the smallness of the opening in the Pitot tube, it collects solid particles easily and tends to clog up. (3) The Pitot tube must be inserted parallel to the fluid stream, any accidental departure from this direction resulting in an error. On the other hand, the great advantage of

this method is the fact that it offers virtually no resistance to flow, and hence causes practically no pressure drop.

A simple impact flowmeter can be made which will have the advantage of causing virtually no pressure drop, and which will not have the disadvantages of the Pitot tube. The solution to the problem is simply to determine the impact pressure of the entire stream, all at once, instead of determining it only at some single point in the stream. This can be accomplished by causing the fluid to change its direction, e.g., by causing it to flow around a 90-deg, bend. The static pressure is determined in the usual way, by means of a tap perpendicular to the original direction of the stream. The total pressure (impact plus static) is determined by means of a tap placed in the elbow or tee, in line with the original direction of flow, as shown in the accompanying figure.

The flow rate determined by such a "meter" follows the

 $Q = C A \sqrt{2g \Delta P/p}$

where Q is the volumetric flow rate, A is the cross-sectional area of the pipe, g is the gravitational constant, ΔP is the impact pressure (i.e., total minus static pressure), ϱ is the density of the fluid, and C is a constant for a given meter.

As an example, the following data were obtained for the flow of air, using a meter consisting of 1-in. pipe and 1-in. tees.

CFM.	ΔP. In. H ₂ O	Reynolds Number	Constant,
0 696 0 813 0 963 1 452 2 07 2 73 3 19 3 68 4 02	0.93 0.44 0.05 1.22 2.58 4.49 6.05 7.43 8.97	3,980 4,650 5,420 8,300 11,900 14,800 21,400 22,000	0.76 0.74 0.80 0.78 0.76 0.75 0.76

It will be noted that the coefficient C is essentially independent of Reynolds number in the turbulent range. However, it appears to be necessary to calibrate each such meter individually.

Many variations of this meter may be made. For example, a 90-deg, bend may be made with a cross, or a

★ JUNE PRIZE WINNER—A \$50 prize will be issued to . . .

GORDON KIDDOO Technical Director, Continental Carbon Co., Amarillo, Texas.

... for an article which presents a new chart designed for the rapid determination of the linear velocity of flow of gases in pipes of various sizes, at temperatures and pressures of various magnitudes. The winner of our June contest, this article will appear in the August issue.

\$50 PRIZE FOR A GOOD IDEA—Until further notice the editors of Chemical

Engineering will award \$50 cash each month to the author of the best short article received that month and accepted for publication in the Plant Notebook.

The winner each month will be announced in the issue of the next month, e.g., the July winner will be announced in August and his article published in September. Judges will be the Editors of Chemical Engineering. Non-winning articles submitted for this contest will be published if acceptable at space sates.

HOW TO ENTER CONTEST-Any reader of Chemical Engineering, other

than a McGraw-Hill employee, may submit as many entries for this contest as he wishes. Acceptable material must be previously unpublished and should be short, preferably not over 300 words, but illustrated if possible.

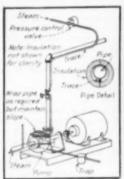
Articles may deal with any sort of plant or production "kink" or short-cut that will be of interest to chemical engineers or others in the process industries. Also, novel means of presenting useful data, as well as new cost-cutting ideas, are acceptable. Address Plant Notebook Editor, Chemical Engineering, 330 West 42nd St., New York 18, N. Y.

180-deg, bend may be made with a return bend. More complicated shapes may also be used to change the direction of the flow. For example, the outlet may be an annular ring instead of a pipe, an opening in the center of the plate may then be used as the total pressure tap.

The location of the static pressure tap is not critical, but it should preferably be immediately upstream of the point where the fluid stream begins to be deflected. The total pressure tap must of course be placed in the path which the fluid stream would have taken if it had not been

deflected.

In the case of a liquid, it is not necessary to determine the static pressure separately, but a differential manometer may be used to determine directly the difference between total pressure and static pressure. For gases, however, it is generally necessary to measure the static pressure separately, so that the weight rate of flow can be calculated from the volumetric flow rate.





Handling Melted Solids With Unjacketed Pumps and Pipe

George T. Austin, Associate Professor of Chemical Engineering, The State College of Washington, Pullman, Wash.

Materials such as 76 deg. Be. caustic soda, stearic acid and similar materials which congeal at room temperature, but melt at the temperature of ordinary steam, can be transported most satisfactorily by pumping. Jacketed pipe and pumps are expensive and occasionally unobtainable, particularly when special materials of construction such as aluminum, stainless steel or Karbate are required because of the corrosive nature of the material being handled. Properly installed outside trace lines have proved to be entirely satisfactory for pumping stearic acid when installed as shown in the sketch. Aluminum or copper tubing will, in general, prove most desirable for the trace lines, although small steel pipe is excellent for long, straight runs. A few simple precautions are necessary to insure trouble-free operation of the installation.

1. The trace line must be sufficiently large to avoid choking with condensate and must be well trapped.

2. All the lines must slope, without any pockets, from the steam feed to the trap. This must be watched carefully when valves and pumps are wrapped.

3. Steam, its temperature controlled to a desirable maximum by the use of a pressure reducing valve, is the preferred heating medium. Ample insulation, carefully applied, is necessary for satisfactory operation.

4. Particular care should be taken with corrosive mate-

rials to protect the heating tube from possible drippage

from leaking packing glands and stuffing boxes on pumps and valves.

5. Select only best quality pumps with good, deep stuffing boxes to jacket in this manner and select the packing with considerable care.

Pneumatic Control For Mill Level

Writing in a recent issue of Power, C. Werderitch described a simple pneumatic control for coal level in a ball mill supplying boilers. Electronic controls previously used had given trouble, so the pneumatic arrangement was worked out and has been giving satisfactory control within

less than a 1-in, range for over a year.

A 1-in. pipe protected inside a 2-in. extra-heavy pipe enters the mill through the feed end and extends to a point about 2 ft. from the mill discharge. The inner end of the 1-in, pipe is bent down and terminated with a nozzle of larger pipe so that the opening just reaches the coal level under normal loading conditions. The carrying 2-in. pipe is supported on a pivot outside the feed end, with its outboard end supported by an adjusting screw so that the inner, detecting end can be adjusted for elevation. The outer end of the 1-in. pipe is then connected flexibly to a slack-diaphragm draft gage provided with two photocells, and appropriate cut-offs mounted on the draft-gage arm.

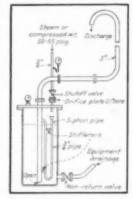
At full boiler load the mill pressure is about -0.2 in. H₂O. When the mill level builds up to a point which just submerges the detecting end of the tube, pressure in the tube drops to 0.0 in. Photocell adjustments are such that when the draft gage pressure rises to 0.05 in., the feeder speed is cut to half, and if the pressure rises to 0.0 in., the

feeder cuts off entirely.

Automatic Blowcase Lifts Liquids By Steam or Gas Pressure

G. JUNGNITZ, Professor, State School of Mines, Recklinghausen, Ruhrgebeit, Germany.

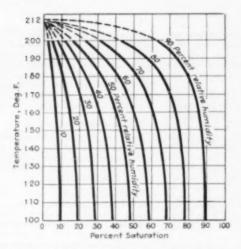
Described here is an automatic blowcase which is simple and foolproof, and can be made readily from materials suitable for the chemical or other properties of the liquid handled. Made of steel it can elevate condensate or other non-corrosive liquids. When constructed of corrosion resisting materials it can handle many liquids which might give trouble in pumps. It can be operated by the pressure of steam, air, or any other gas suitable for the liquid being pumped. This particularly



convenient for moderate-sized installations and can pump to any height dependent only on the specific gravity of the liquid and the available gas or steam pressure.

The blowcase has no moving parts. Liquid enters by gravity through a non-return valve, flowing into a closed vessel which in the particular installation described has a capacity of 180 gal. The dimensions and quantities given are for this installation and must be modified to suit conditions in other cases. Air, steam or other gas enters through

a 3-in. line fitted with an orifice plate having a bore of approximately 0.1 in. While the vessel is filling the gas escapes (steam condenses) by the 3-in riser pipe. However, as soon as the rising liquid closes the inlet of the siphon pipe, the internal pressure builds up and forces the liquid up the riser until the vessel has been emptied, except for the small volume below the riser inlet. In the case described pressure reaches about 10 psig, for a 21-ft. static discharge head. Filling requires about 3 min. and discharge about 4.5 min. As soon as the siphon is cleared, atmospheric pressure is restored to the vessel and liquid again enters through the check valve.



Relation Between Relative Humidity And Percentage Saturation

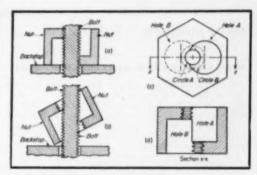
JOSEPH T. HOGAN, Chemical Engineer, New Orleans, La.

The moisture content of gases may be designated in several ways but the index commonly employed by the engineer is that of the relative humidity of the mixture. Relative humidity is the ratio, usually expressed in percent, of the pressure of water vapor present in the gas, to the saturation pressure of water vapor at the temperature of the gas. In practice, relative humidity is sometimes defined as the ratio of the weights per unit volume of the water vapor in the gas mixture, and the saturated vapor at the temperature of the gas mixture. This latter definition of relative humidity is more properly termed percentage saturation. Both terms, however, differ from the absolute humidity of a gas, which is the weight of water vapor per unit volume of mixture, i.e., grains per cubic foot.

In the literature the terms relative humidity and percentage saturation are often used interchangeably and are considered equivalent for all practical purposes (Nat. Bur. Stand., Instruments for Measuring Humidity, LC946, 1949). While it is true that for temperatures of 100 deg. F. and lower, the relative humidity and percentage saturation are essentially equivalent numerically, these two quantities differ widely for temperatures in the range of 100-200 deg. F.

The accompanying chart illustrates the differences existing between the relative humidity and percentage saturation for air over the temperature range 100-200 deg. F., for an atmospheric pressure of 29.53 in. of mercury. The curves have been extrapolated for the range 200-212 deg. F.

and are shown as dotted lines in the chart. It is interesting to note the degree of variation for the higher temperatures of air. For example, at 194 deg. F. and a relative humidity of 90 percent, the percentage saturation is 70 percent. This means that the air has 70 percent of the weight of water vapor necessary to saturate it at 194 deg. F.



Quick-Lock Nut Is Useful For Equipment Closures

WALTER G. THOMSON, Minneapolis, Minn.

In many kinds of equipment, for example, batch type ball mills, it is necessary to have a removable door or panel which is secured during operation by bolts and nuts spaced around the periphery of the door. Especially where the operating cycle is short, opening and closing such an arrangement tends to become an important time factor, and particularly when opening to take samples is required at frequent intervals.

The unique type of nut described here largely overcomes these difficulties, since it can be disengaged and slipped off the bolt after about one complete turn. Sketches a and b are cut-away views of the nut. Sketch a shows the nut in the engaged position, tightened against the "backstop." In sketch b the nut has been disengaged and tilted for slipping off the bolt. Sketches c and d together show how the nut is constructed.

Referring to sketch c, which shows a top view of the nut, circle A represents the inside of the threads and circle B the root of the threads. Holes A and B, which should intersect each other on or slightly outside circle B, have their centers on the same straight line with circles A and B. Each of these holes is machined about two-thirds of the way through the nut, one from the top and one from the bottom. The cross-section in sketch d shows what the finished result will be. The threads are exaggerated, of course, to make the construction clear.

It will be readily apparent how the nut works. When it is tipped the threads disengage and allow it to be slipped along the bolt. To engage it, it is slid into position and rotated in a clockwise direction from the position of sketch b until it lies flat on the backstop. A turn or so in the usual manner then pulls it up tight. Analyzing the forces involved, it is clear that the horizontal components of the forces at the thread will be equal and opposite, but the vertical components, although equal, will form a couple which means that the reaction from the backstop will be greater on the lefthand side, thus causing the nut to tighten harder on that side. The practical consequence of this, of course, is that the nut will not lock unless it is tightened against some rigid surface.

Calculate Payout Time for Your

This is a new empirical way to calculate the time it will take to pay off a capital investment. It is versatile, easy to use, may help you keep your capital

WILLIAM L. FAGLEY and GEORGE W. BLUM

It is often desirable to calculate the "payout time"—the number of years before an investment is recovered by added earnings—before investing in new production facilities. This is true whether it is a new enterprise, an expansion, or a diversification of an existing plant that is being considered. A calculation will often show that the risks from a payout period that is too long do not justify interrupting an existing capital structure that may be smaller but secure.

Normally, payout time should be determined to compare (1) the attrac-

WILLIAM L. FAGLEY, now with Dow Chemical Co. in Midland, is a recent chemical engineering graduate of Case Institute of Technology. Coauthor George W. Blum is assistant professor of chemical engineering at tiveness of several possible new ventures, (2) the attractiveness of a single venture of relatively high risk, or (3) the relationship between the payout time and the expected life of the new facilities.

All empirical methods of determining payout time that are in common use are based on limiting assumptions; this requires a careful choice of the method to use. Their complexity varies a great deal, depending on the number of factors that are considered. Many of these factors have a marked effect on the accuracy of the calculated time; hence the various methods give a wide variation in the payout time. We suggest in this article a new empirical relationship that we believe will be (1) more accurate, (2) more versatile, (3) easy to use.

The classical calculation is simply to divide the investment by the gross

earnings that it makes possible.' This neglects interest charges and taxes. Therefore it gives a distorted picture of the cost of the invested capital. It does have, however, the advantage of being easy to determine. Nor does it require estimates of uncertain tax rates, interest or depreciation.

BUELL'S TWO METHODS

Buell^a has given a more acceptable method which is also easy to use. It takes into consideration the tax rate on earnings and indicates a depreciation factor. The Buell formula is:

T = I/Z (1) where I is the investment in new facilities; Z is S(1-t) + tD; S is the

cilities; Z is S(1-t) + tD; S is the net annual savings made possible by the new facilities; t is the tax rate applicable to earnings; D is the annual depreciation for tax purposes.

Fagley-Rum Methods of Calculating Payout Time at End of Payout Period

	By 3 Percent De Original	Alternate	By 4.6 Percent Original	Preferred Stock	By Rotained Earning Original	ge or Common Stock Alternate
Equation for T*. Payout time in years Assumulated not profit?	(1-t)S - I(i+r-n) 4.72	(1-0)S+I(n-0) 4.14 \$798,000	(1-0)S-I(2r"-n) 8.89 \$1,235,000	(1-6)S+I(n-r") 4.65 \$077,000	(1-6)8-I(2r'-n) 7.70 \$1,625,000	(1-0)S+I(n-r') 8.13 \$1,078,000
Depreciation reserves on new facilities at end of period	236,000	207,000	295,000	232,000	375,000	286,000
Total interest or dividend pay- ments during period	142,000	124,000	265,000	200,000	800,000	334,000
Retained not profit from new facilities	906,030	798,000	970,000	768,000	1,125,000	744,000
Beck value of new facilities at end of period	764,000	793,000	705,000	766,000	625,000	744,000
Excess of retained net profit over book value of new facilities		0	265,000	0	800,000	0

* See test for explanation of formulae and of nomenclature.
† After interest and taxes when debenture bonds are used; after taxes before dividends when preferred stock, retained earnings or common stock are used.

To compare the various methods of calculating payout time, we will assume that the company plans to invest \$1,000,000. The new plant will yield a net profit before taxes and interest or dividends of \$550,000 per year. It will be depreciated \$50,000 per year or at the rate of 5 percent for 20 years. We will assume that total taxes on income from all sources are at

the rate of 40 percent. The present rate of earnings on the company's common stock is 6.5 percent. The new production facilities may be financed by debenture bonds at 3 percent interest or by an issue of preferred stock at 4.5 percent. Then, I=\$1,000,000; S=\$550,000; D=\$50,000; t=0.40; t=0.03; t'=0.065; t''=0.045; t=0.018; t=0.05.

These tables compare the length of the payout period when the different formulas given in this article are used. In them we have assumed (1) that the yearly profit before interest and taxes is constant over the payout period and (2) that the tax rate on carnings, yearly depreciation, interest and/or dividend rate is constant over the payout period.

Investment

structure sound.

This method is not fully adequate; it fails to take into account the interest rate, cost of getting the capital, or the full value of the yearly reserve for depreciation. Buell has, however, suggested a revised method for calculating payout time that includes several of these factors:

$$T = \frac{\log Z - \log (Z - iI)}{\log z - \log y}$$
(2)

where Z, T, t, and I have the same relationship as in Eq. (1) and i is (1-t)r or the effective rate of interest x is 1 + i/2; y is 1 - i/2.

terest; x is 1 + i/2; y is 1 - i/2. Yet this method is limited. It cannot be used when the new investment is financed by retained earnings or from the sale of common stock; nor can it be used under any capital financing where the effective rate of interest is zero. The method does not give

Shell Methods of Calculating Payant Time

Buck Nethods of C	seconstruct	Payout Lime
	Simplified Method	Log Method $\log Z - \log(Z - Ii)$
Equation for To	1/2	$\log x - \log y$
Method of financing Payout time in years Accumulated net profit?	4.17	2% deb. bonda 4.54 \$870,000
Depreciation reserves or facilities at end of period.	208,000	227,000
Total interest payments during period Retained not profit from		136,000
new tacilities. Book value of new	875,000	870,000
facilities at end of period	792,000	773,000
profit over book value		97 900

* See test for explanation of formulas and nomes clature. † After interest and taxes.

The differences in results from Eqs. 1, 2, 4 and 5 are not too great; this is especially true when original estimates of the magnitude of the investment and net profits are made prior to actual getting of the capital. However, Eq. (4) gives the most conservative answer. Thus any deviation between estimated requirements and actual requirements is minimized.

full recognition to yearly depreciation. In addition, it is just often not convenient to use five-place logarithm tables.

All established ways of calculating payout time assume that net annual carnings, tax rate and interest rate are constant. When the tax rate and net annual earnings vary, then the payout time must be calculated stepwise, year to year; this takes the variations into account so that the capital recovered each year can be determined. This method gives the most reliable value for payout time. But the calculation becomes tedious and time-consuming.

OUR NEW METHOD

We suggest a new empirical relationship that (1) eliminates many of these tedious calculations and (2) can be applied to new capital investment that is financed by common stock issue, use of retained carnings, issue of preferred stock or the assumption of new bonded indebtedness.

New production facilities may be considered paid off when the accumulated net yearly profit after taxes and interest charges is equal to the adjusted investment. After T years, the investment will not necessarily be I; the facilities have been depreciated by an amount TIn, with an interest payment of TIr to bond or note holders. Thus, after T years the capital investment in the new facilities will be I - TIn + TIr. Since the adjusted investment must take into account the full amount of interest paid to bondholders, the use of the full interest rate would be more valid than the effective interest rate. When depreciation and interest rates are equal, then I will again represent the total investment at the end of T years.

Yearly profit after investment charges and taxes will be (1-t) s—Ii. Here the effective rate of interest is used since interest expense can be deducted from income taxes. While the bondholders actually renoit reduced by a like amount because of the tax deduction. This accounts for the so-called "effective rate of interest" rather than the "full" interest rate. If the tax rate, yearly earnings before taxes and interest, and interest rate are all constant during the payout time, then:

$$T[(1-t)S-Ii]=I-TIn+TIr \quad (3)$$

Thus accumulated yearly net profit is equal to the adjusted value of investment after T years. Here T, I, t, S, i and r are the same as in Eq.

(2); n is the percentage of investment depreciated each year, n = D + I.

Thus Eq. (3) may be considered as the basic payout equation. It can be simplified by solving for T:

$$T = \frac{I}{(1 - 0S - I(i + r - n))}$$
 (4)

Industrial management now generally favors the financing of new production facilities by "plowing back" retained earnings. Five primary factors should be considered in choosing the method of new financing:

(1) how easy and how long it takes to get new capital;

(2) actual cost of the capital;

(3) terms of the repayment;

(4) the degree of risk involved;

(5) government policies on taxes and its attitude toward "bigness" of individual corporate enterprise.

New capital is often needed immediately, and there may not be time to sell an issue of preferred stock or debenture bonds. If the capital is not available at once, construction work may be held up long enough to allow a competitive product to capture the best prospective markets. From the cost point of view, issuing bonds or notes is the cheapest financing; issuing preferred stock is more costly; using common stock and retained earnings is most expensive.

This assumes that if the financing comes from retained earnings or the sale of common stock, the new facilities must vield a return on the investment at a rate no less than the present yield on common stock outstanding. Otherwise the stockholders would have been better off if the investment had not been made or had been financed by other sources of capital. This has been shown by Soule in his discussion of the economics of aggressive research*: "The financial test of its [research] success is not simply whether or not such an investment returns a profit to the company. It is whether the results thus obtained are enough to produce some net gain to the stockholders."

Bonds and notes (and to a related degree, the preferred stock issue) carry specific stipulations for repayment. They are therefore less desirable as a source of capital for a risk investment. The planned new investment will have a marked effect on the proper choice of capital sources, depending on whether or not it is intended to fit into the company's established experience or products or is to be considered as capitalization for diversification into new and untried fields.

Leon Henderson's opinions' repre-

sent those of one segment of political economists. He feels that industry should be discouraged from "plowing back" earnings. He would rather have these distributed to common stock owners. In order to accomplish this, he advocates an increasingly confiscatory tax structure to drain off a high percentage of retained carnings. Henderson's views are based on the likelihood of a greater tax return to the government on individual incomes as well as his fear of an increase in the "bigness" of business. He also fears an increasing independence of corporations for new, small investment capital from outside sources.

Therefore it seems advisable to consider separately the payout rela-tionship that results from various sources of investment financing. If the new production facilities are to be financed by retained earnings or by the sale of common stock, Eq. (4) should be modified so that r = = the present yield on common stock. Since dividends are not deductible before taxes, the yearly income will be reduced by Ir' instead of Ir. The payout formula then becomes:

$$T = \frac{I}{(1-i)S - I(2r'-n)}$$
(4a)

This formula can be used for financing by common stock or by retained earnings. If a preferred stock issue is used to finance the new investment, then r" or the rate of preferred dividend will replace r' in Eq. (4a).

Where mixed financing is used, the payout formula will be:

$$T = \frac{I}{(1-t)S + In - 2aIr' - bI(r+i) - 2cIr''}$$

Stated, this becomes: payout time in years = investment + (company share of profits after taxes + yearly depreciation - cost of common stock financing - cost of bond financing cost of preferred stock financing). Here a, b and c are the fractions of the investment financed by retained earnings and/or common stock, honds, or preferred stock respectively. The ease with which this formula can handle all methods of financing the new investment is a considerable advantage over other methods of calculating payout

Should the cost of financing be included when calculating the adjusted investment? This is controversial, Therefore, alternate proposals are given for the relationship shown in Eq. (4). These are based on the assumption that interest charges and dividends are current expenses-hence are not valid factors in estimating the investment value after a given period of years. Thus the following relationships do not consider dividends and interest payments in the adjustment of capital investment:

For financing by bonds:

$$T = \frac{I}{(1-t)S + I(n-i)}$$

For financing by common stock or retained earnings (use r" for preferred stock financing):

$$T = \frac{I}{(1-t)S + I(n-t')}$$
(5a)

For financing with capital obtained from varied sources:

$$T = \frac{I}{(I-I)S + In - aIr' - bIn - cIr'}, \quad (5b)$$

The alternate proposal is less conservative than the basic payout formula (see tables). Any error in estimating such factors as tax rates, magnitude of investment and yearly earnings may become magnified to such an extent that the investment may be undertaken without fully realizing the risks involved. Because of the varying degrees of conservatism shown by many corporations today, the alternate proposal has been included as an aid in making a more judicious choice of payout formula.

Advantages of using Eq. (3) for calculating payout time are: (1) the true effect of interest is shown with greater emphasis; (2) it shows what effects taxes have on earnings; (3) it recognizes the full effect of depreciation reserves; (4) it is readily modified to handle different methods of financing the new investment; (5) it is a more conservative way of calculating since it includes the interest paid out to finance the investment (see examples). In addition, Eqs. (3) and (4) are just as readily solved for S, the net yearly profit, if an allowable maximum payout time is known.

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FOR RESEARCH Glenn H. Wagner



FOR RESEARCH & DEVELOPMENT New Alcoa Laboratories at East St. Louis



FOR DEVELOPMENT James W. Newsome

For New Emphasis on Alumina & Fluorides

East St. Louis, Ill., birthplace in 1902 of Aluminum Ore Co. and for 35 years the sole source of Alcoa alumina, now boasts the country's most modern facilities for research and development of chemicals derived from bauxite and fluospar. More than fifty distinctive forms of alumina and fluorides

helped set the stage for the dedication on May 24, 1950 of a new branch of Alcoa's Aluminum Research Laboratories. The team in charge is headed by (1) veteran Research Director Glenn H. Wagner, inventor of important processes for sodium arsenate and aluminum fluoride, and (2) Development Chief James W. Newsome, noted for his patents on activated alumina, oxide coatings and his part in the development of the combination process for recovering alumina from low-grade bauxite. From these new laboratories industry can confidently look for further advances in many fields.

SLIDE RULE TRICKS

How to get more work out of your slipstick. You can combine constants and make the rule pinch hit for tables of data.

HENRY ECKHARDT

Nomographs are widely used in order to facilitate engineering calculations. Such aids to computation are useful; however, the engineer often forgets that he has on hand an adjustable two variable nomograph which is suitable for the solution of a wide variety of problemsthe slide rule. We are not concerned here with the use of the slide rule for solving the equations of engineering in the customary manner, although a few ordinary manipulations are involved in the solution of certain problems considered. Rather a method is outlined for obtaining the solution of several physical and engineering functions which are not ordinarily accomplished with the slide rule, either because the necessary steps by the ordinary methods are too involved, or because there are no known analytical

Crux of the method is to combine the constants of the function into a single constant which is used as a gage point on the slide rule, and, when necessary, to alter the form of the function to a type which can be solved with a slide rule by a single setting. For example, the equation in common use for the Reynolds Number function for clean standard steel pipe'.

$$\phi N_{Bs} = 0.0001906 + [0.01171/(N_{Ba})^{0.23}]$$

This requires at least two settings of the slide rule and a four-figure addition; moreover, for part of the range of Reynolds Numbers occurring frequently in practice, the Reynolds Number falls off the scales of an ordinary slide rule, thereby necessitating two additional settings of the rule; however, D. S. Davis has shown how this function can be solved in a single setting of the slide rule, which in effect, employs another equation approximating Eq. (1) in the desired range.

This article presents the methods for obtaining by means of a log-log slide rule a solution of the following relations:

Wire gage-Wire diameter. Reynolds Number function-Reynolds Number. Hydraulic friction factors-Reynolds Number. Temperature-Vapor pressure of steam. Temperature-Vapor pressure of other liquids. Temperature-Vapor pressure of ammonia.

Temperature—Enthalpy of evaporation for steam. Temperature—Total enthalpy of saturated steam.

All of the above relations are solved directly in the com-

mon engineering units. In order not to have the proposed methods appear formidable, only the basic outlines of the methods are given here. It is assumed that the reader is entirely familiar with all the terms mentioned and the background. Fur-

thermore, to condense this article, no derivations are given, and when not necessary, even the equations are omitted, and only the slide rule settings are given. In passing, it should be noted that the slide rule has much

greater precision than is required for most data that are slipped on it. It is assumed that the reader is aware of

HENRY ECKHARDT, Industrial Consultant of Bayside, L. I., was the sparkplug on our articles on equipment cost. Here he has come up with another idea to help you.

the actual precision of ordinary physical and engineering data, and moreover, the magnitude of the deviations of the actual prime variables from the assumed or measured values used in a computation.

To simplify some of the solutions, they are expressed directly in terms of the slide rule settings. Illustrating the convention employed, the following example should

The relation between the diameter and area of a circle is given by the equation

$$a = xd^2/4$$
 (2)

The equivalent slide rule setting is denoted by

$$C(1)/D(d) = A(a)/B(\pi/4)$$
 (3)

The capital letters denote the scales of the slide rule and the letters or figures in the parentheses denote the corresponding scale reading. Obviously, the same slide rule designation is employed in solving for either a or J.

WIRE GAGE-WIRE DIAMETER

The wire diameters in the AWG or B&S gage for successive gage sizes are in the ratio of 9210. The full scale ranges from No. 0000, the largest, to No. 40, the smallest, pivoted about the No. 36 gage, which is taken at 5 mils diameter. There is the choice of several methods for obtaining this simple analytical relationship on the slide rule. The method which gives the result in a single setting for all gage sizes over the entire scale is based on a calculation which pivots the scale on a hypothetical gage of 49.88. which would be one mil in diameter. In place of setting the ratio 921/m (1.122932. . .) on the LL2 scale, it is more convenient to employ the gage point 1159 on the D scale. The method is exact; the accuracy is limited only by the precision of the slide rule employed. Let d =wire diameter in mils, G = gage number (algebraically). Thus, a No. 0000 wire is -3 on an algebraic scale.) Then the slide rule setting is

$$C(1)/D(1159) = C(49.88 - G)/LL3(d)$$
 (4)

The left index of the C scale is used for all settings. Example—Find the diameter of a No. 10 B&S gage

Set the left index of scale C opposite the constant gage point 1159 on scale D. 49.88 minus the gage size, 10, is 39.88. Then opposite 39.88 on scale C, find 102 on scale I.L3. The wire diameter for a No. 10 B&S gage wire is thus 102 mils. (See Fig. 1, p. 120.) Example—Find nearest B&S gage size for a 0.020-in.

Same setting of slide as for above example. It is only necessary to move the indicator to a new position. Thus opposite 20 on scale LL3, find 25.84 on scale C. Then the gage size, G, equals 49.88 minus 25.84, or 24.04. Thus the given size is slightly smaller than a No. 24 gage, the latter being 20.1 mils diameter. (See Fig. 2, p. 120.)

There are two other slide rule solutions, although these

are not as practical generally: one is pivoted on the No. 36 gage, and the other on a No. 30. These two methods

have the advantage of integral exponents, but a second setting is required on the slide rule for all wire sizes smaller than the pivot size. Moreover, the former method requires an additional mental multiplication, and the latter is an approximation.

BEYNOLDS NUMBER FUNCTION

The Reynolds Number function is used to determine the fluid friction head by means of the modified Fanning equation.4

$$F = \phi N_{Ba} L \omega^{2}/D \qquad (5)$$

where $\phi N_{\mu\nu}$ = the Reynolds Number function, F = fluid friction head, feet of fluid flowing, L = length of pipe, feet, D = inside diameter of pipe, feet, u = velocity of stream, feet per second.

Reynolds Number function is a condensation of the fluid friction factor, f, and the constant term 2/g, which occurs in the original form of the Fanning equation. (See Eq. 14, p. 377 in Perry.") Thus

$$\phi N_{Bs} = 2f/g_s \qquad (6)$$

where g. = 32.17 lb., ft./lb., sec. is the dimensional constant. Following this section a similar condensation of factors is suggested which will expedite the calculations for determining the Reynolds Number itself.

Pipe friction factors vary with the state of flow-viscous or turbulent-the nature of the interior pipe surface, varying from the smoothest drawn tubing to the heavily incrusted iron pipes. Viscous, or streamline flow, is considered to hold up to about Nax 2,000, and stable turbulent flow from about Na. 4,000 upwards. For the unstable transition zone it is safer to take the friction factors for N_n, 4,000 in the turbulent condition. Also for Reynolds Numbers above two million use the minimum value of the friction factors corresponding to N_s, 2,000,000.

In the viscous flow region the fluid friction is independent of the internal pipe surface conditions. The equation is

$$\phi N_{Bs} = 1/N_{Bs}$$
(7)

In the region of turbulent flow the fluid friction is dependent on surface conditions inside the pipe. Several slide rule nomographic solutions are available for new commercial steel pipe. Reference has been made already to Davisa who devised a method for obtaining the Reynolds Number function, or friction factor, from a single setting of a log-log slide rule. His method has been modified so that the gage points are set on the log-log scale, which results in settings which are more convenient for mnemonic reasons. The modified slide rule setting for the turbulent range of No. from 4,000 to 2,200,000 is

$$C(1)/LL3(N_{Be}/100) = C(10^{e} \phi N_{Be})/LL3(GP)$$
 (8)

where GP denotes the gage point employed (other symbols as before). For all cases, the right hand index of scale C is employed. The factor 10' set before the Reynolds Number function on scale C locates the decimal point properly, the C scale is assumed to range from 1 to 10; however, in actual use it is simplest to disregard this factor, since all values of the Reynolds Number function in the turbulent range have three zeros after the decimal point.

As a first approximation, a gage point of 11 is generally applicable for practical calculations. Useful range: Nac 4,000 to 1,000,000.

Example-Find the Reynolds Number function for a Reynolds Number of 50,000.

Referring to Eq. (8), set the right C index opposite 500 on the LL3 scale. Opposite the gage point 11 on the LL3 scale, find 386 on the C scale. Place the decimal point followed by three zeros before this reading and obtain 0.000386 for the Reynolds Number function. The value computed by Eq. (1) is 0.000382; consequently, the value computed by slide rule is only about 1 percent greater. (See Fig. 3 below.

It should be noted that the empirical data on which Eq. (1) is based scatter widely, and the deviation between data and Eq. (1) may be as much as ±10 percent. Despite this, at times it may be expedient to have the solution by slide rule correspond even closer to Eq. (1), for the sake of having calculations which will agree with those made by

Sample Settings See text for how and why these results are obtained



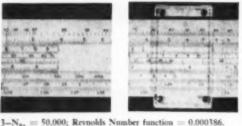


2-0.020-in. wire is No. 24 B & S gage.



1-No. 10 B & S wire is 102 mils.







4-Steam at 150 psia. is 360 deg. F.

other methods, although intrinsically the accuracy of the experimental data does not justify this.

Second approximation: The gage point 11 is restricted to the range above about N_{ss} , 20,000, and a second gage point of 12.5 is used in the lower turbulent range from N_{ss} , 4,000 to 20,000.

Third approximation: In order to secure still closer agreement with Eq. (1), one can obtain a simple correction term from the slide rule with which to adjust the gage point in the range from $N_{\rm th}$, 20,000 to 2,200,000, so that the maximum error is under 1 percent. The variable gage point is obtained by adding 300 times the reading on scale LLO3 to the constant 10. This reading is obtained when the right hand index of the slide is set opposite $N_{\rm th}$ /100. The correction term is carried to only one significant figure after the decimal point, and the simple calculation is performed mentally. Thus, in the form of an equation, the variable gage point as a function of the Reynolds Number is

$$GP = 10 + 30000/N_{Ba}$$
 (9)

Example—Find the Reynolds Number function for N_s, 50,000, using the variable gage point.

As before, after Eq. (8), set the right index of C and the slider on N_{2n}/100, (in this case 500) on the LL3 scale. On LLO3 find 0.002,—multiply by 300 and get 0.6,—plus 10 gives 10.6 for the variable gage point. Opposite 10.6 on scale LL3 find 380, or ϕN_{zz} equals 0.000-380. The exact value by Eq. (1) is 0.000382, a difference of about 0.5 percent.

The applicability and precision for the three methods are summarized in the following table.

Gage Point	Applicable Range of Reynolds Numbers	Root-Mean- Square Deviation From Eq. (1), Percent
11	4,000-1,000,000 20,000-1,000,000	<3.7
12.5	4,000 20,000	<1.7

FRICTION FACTORS "F"

Since the use of the Reynolds Number function is more convenient than the use of the friction factors, the latter are necessary only for correlating calculations with other work; consequently, for such occasional use the most convenient way is to determine the Reynolds Number function in the usual way with the slide rule using either Eqs. (7) or (8) depending on the conditions of flow, and multiply this value by the conversion factor 16.09, since by Eq. (6)

$$f = \frac{1}{4} g_e \phi N_{Rs} = \frac{1}{4} 32.17 \phi N_{Rs} = 16.09 \phi N_{Rs}$$

The f referred to here is the Fanning friction factor used in chemical engineering treatises. The f used in hydraulic treatises is applicable to the Darcy equation and it is exactly four times as large as the folmer f. Thus

$$f_{\text{Decoy}} = 4 f_{\text{Fanning}}$$
 (11)

For most practical purposes, the conversion factor for converting from Reynolds Number function to friction factors may be taken as 16 and 64 for use with the Fanning and Darcy equations, respectively.

Engineers having frequent use for the I friction factors may find it more convenient to determine them directly by means of their corresponding gage points. Determination of these supplementary gage points is left to the reader. Hint: the required gage points may be taken on any of the fixed scales of the slide rule. For example, multiplying the Reynolds Number function by 16.09 per Eq. (10) is equivalent to altering the gage point 11 on the LL3 scale to approximately 47 on the LL3 scale, or better still, precisely 0.68 on the LLO2 scale.

COMPUTING THE REYNOLDS NUMBER

In passing, a hint is given of a method for computing the Reynolds Number quickly. The work of computation is shortened by combining all the conversion factors into a single constant suitable for the system of units employed. E. M. De Forest has shown how this can be done, and he has presented his condensed conversion factor in a set of three tables'; however, since the factor is constant the Reynolds Number can be found directly from the slide rule, thereby obviating the need for double entry tables and interpolation. Briefly, the crux of the method is to take water as a reference liquid and assign unit specific gravity and unit viscosity to it. Water at 68 F. deg. has a viscosity of 1 centipoise; consequently, the specific viscosity of any fluid (compared to water at 68 deg. F.) is numerically equal to its viscosity expressed in centipoises, the latter unit being the most commonly employed in reference tables. Similarly, specific gravity is numerically equal to the density expressed in the metric system. Indeed, these units are commonly confused, although practically it makes little difference.

Consider the flow of water at 68 deg. F. at moderate rates where Q = flow gallons per minutes and d = denotes the inside pipe diameter, inches. Then,

$$N_{Bo} = 3,160Q/d$$
 (12)

For any liquid at any temperature multiply Eq. (12) by the specific gravity and divide by the specific viscosity of the liquid, thus

$$N_{Re} = 3,100 Q(8G)/d(8V)$$
 (13)

where SG = specific gravity and SV = specific viscosity.

Example—What is the Reynolds Number for a 40 percent sucrose solution at 20 deg. C. flowing at the rate of

50 gpm. in a 3-in. Sched. 40 pipe?
Original data: I.D. of 3-in. Sched. 40 pipe is 3.068 in.;
SV of sucrose solution is 6.223; SG of sucrose solution is 1.1764. Substituting these in Eq. (13)

$$N_{Re} = (3, 160) (80) (1.176)/(3.07) (6.22) = 15,570$$
 (14)

SATURATED VAPOR PRESSURE OF WATER

The saturated vapor pressure for water can be determined approximately from a single setting of the slide rule and a simple mental calculation by means of the following equation.

$$t = 200 (p)^{1/8} - 101$$
 (15)

where t = temperature, degrees F., and p = pressure, saturated water vapor, pounds per square inch, absolute.

This equation gives results correct to within 3 deg. F. in the range from 1 to 350 psia; conversely, the maximum error in the computed pressure may be 6 psi. at 350 psia. Even at 1,000 psia. the calculated temperature is only 22 deg. F. too low, which represents an error of less than 5 percent of the temperature range from normal terrestrial temperature to the temperature of the steam, at 545 deg. F. This equation is therefore sufficiently accurate for most heat transfer calculations, and it has considerable application to practical problems involving the determination of steam temperature-pressure relation when a steam table is not at hand.

Example—What is the temperature for saturated steam

at 150 psia? (See Fig. 4, p. 120.)

By slide rule: 150 = 2.305; multiplying mentally by 200 = 461; subtracting 101 yields 360 deg. F., the answer. The value given in current steam tables is 358.43 deg. F.

Example-What is the pressure for saturated steam at 150 deg. F7

Adding 101 to the temperature = 251; dividing mentally by 200 = 1.255; by slide rule 1.255; 3.91 psia., the ARSWET.

The value given in the steam table is 3.726 psia,

VAPOR PRESSURE OF LIQUIDS

The classical functions for calculating vapor pressures are not adapted well for slide rule manipulations; moreover, it requires a minimum of two constants for each substance. For example, the equation may be'

$$\log_{\theta} dp = B - 52.23A/T$$
 (16)

A much simpler vapor pressure—temperature function which approximates the true values for many substances can be derived from Eq. (15) by application of the prin-ciple of the Duehring Rule. This equation is adapted for slide rule computation and it requires only a single datum for any substance, its normal boiling point. When necessary, any other point on the vapor pressure-temperature curve could be utilized instead, although this would involve the additional step of first finding the normal boiling point for the substance. Without detailing the matter explicitly, it is sufficient to state that there is a substantially fixed temperature difference between two liquids compared at the same vapor pressure. This approximation is closest for chemically similar substances. For our present purpose water is taken as the reference liquid, for which we already have a simple function for the pressure -temperature function, Eq. (15). Thus, the general equation becomes

$$t + 101 + (212 - NBP) = 200p^{1/4}$$
 (17)

where N.B.P. = normal boiling point degrees F., for the subject liquid and p = the corresponding vapor pressure,

The two constants may be condensed into one and the equation rewritten

$$t = NBP - 313 + 200(p)^{1/6}$$
 (18)

which holds approximately for nearly all liquids.

This equation will give good results whenever the slope of Duchring Line is substantially equal to unity, and when the curvature of the line is slight. Unfortunately, one can not predict the degree of precision, although even chemically dissimilar substances may yield satisfactory results. The disadvantage can be obviated when the engineer deals frequently with the same liquid, so that beforehand the precision and useful range of pressure and temperature for Eq. (18) are known.

In order to illustrate the accuracy attained, the results of some calculations made for several substances selected at random are given:

	NBP.	Given Pressure.	Corresponding Deg.	
Bulatasee	Dog. F.	Pais.	Cale.	Actuals
Ethanel	173	22.96	197	194
Diethyl other		3.383	29	200
Methanoi	148.5	36.65	200	336
Carbon bisulphide Bromine	137 6	1.074	313	2.7
Assessment	$-28 \cdot 1$	53.73	47	2.5

The data and calculated value for ammonia are included in the table in order to illustrate a failure for Eq. (18). This is because the Duehring Line for ammonia with water as the reference liquid has a slope of about 1.44-a 44 percent deviation. Obviously, in order to obviate large errors it is necessary to devise another simple equation for the vapor pressure-temperature relationship for ammonia:

$$t = 110p^{8.100} - 216$$
 (19)

Symbols and units are the same as before. The maximum error does not exceed 2 deg. F. over a range of temperature from -100 deg. F. (1.24 psia.) to 175 deg. F. (~600 psia.); consequently, this equation is applicable to ordinary refrigeration calculations.

It might be expected that Eq. (19) would be the prototype equation for another family of substances. To the contrary, however, a comparison with several alkylamines showed that ammonia appears to stand alone as a chemical substance since better correlation could be obtained for such compounds by using water as the reference

The equations devised for water and ammonia illustrate how the field of application can be extended for other substances. Whenever the slope of the Duehring Line plot departs appreciably from unity, a prototype approximate equation could be devised to give the vapor pressure -temperature relation for any given liquid.

ENTHALPY OF SATURATED STEAM

When a steam table is not at hand, both the enthalpy of evaporation and the total enthalpy for the saturated vapor can be calculated by means of the following equations:

Enthalpy of evaporation:

$$h_{fg} = 142(676 - t)^{0.803}$$
 (20)

Enthalpy of saturated vapor:

$$h_0 = 1.828 + t - (1.250,000)/(1.618 - t)$$
 (21)

where t = temperature, degrees F. and enthalpy is expressed in units of Btu. per pound.

Eq. (20) is based on the Henning formula for the heat of vaporization" and Eq. (21) is based on the Power formula" for the total heat of saturated steam. Both equations have been revised in order to have them conform closer to the currently accepted values of the properties for steam, and Eq. (20) has been adapted for slide rule computation. Both equations practically equal the ac-curacy of a 10-in., slide rule over the full prescribed ranges, and at about 1 atm. pressure the errors for either equation are negligible.

Eq. (20) is valid over the range from 32 deg. F. to about 500 deg. F. The maximum error is under 0.3 percent, and the root-mean-square error is less than 0.18 percent.

Eq. (21) is valid over the range from 32 to about 400 deg. F. The maximum error occurs at the lowest temperature, the error being less than 0.3 percent. The rootmean-square error is under 0.14 percent. The total enthalpy in the range from 400 to about 500 deg. F. can be approximated easily from the fact that this property reaches a maximum of 1,205.0 Btu per lb. at about 454 deg. F., and falls to 1,202.0 Btu per lb. at 500 deg. F. Thus, this function has slight curvature over the range from 400 to 500 deg. F., and the total enthalpies for two states at an equal temperature interval above or below 454 deg. F. are substantially equal.

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News From Altroad

SPECIAL CORRESPONDENCE

Better Days Ahead for U. S.-Brazil Trade

Rio de Janeiro—Trade figures for the first quarter of 1950 point up clearly why American export managers have been wringing their hands over the Brazilian market. Tabulation shows that Brazil's 10 leading imports from the U.S.A. fell more than \$53 millions in that period, compared with a year ago.

These same exporters appear to have cause to rub their hands in anticipation of better times to come, however. In the same period Brazil's 10 leading exports to the U.S.A. showed a gain of more than \$20 millions over first quarter 1949, boosting Brazil's increasing surplus U. S. trade balance.

British Open New Rubber Research Center

London—The largest rubber research in the British Commonwealth was opened at Fort Dunlop in June. Housing 50 fully equipped laboratories, the center was built by the Dunlop Co. primarily to serve its 25 British and 16 overseas factories, but it will also cooperate with other organizations using rubber or allied products and with the research center recently opened by the company in Malaya.

Brazil's Cement Output To Be Increased

Rio de Janeiro—A \$2,070,000 U. S. Export-Import Bank loan to a Brazilian subsidiary of the Lone Star Cement Corp. will add another 100,000 tons to annual cement production in Brazil.

The new plant will be located at Salvador in the northern state of Bahia, where imported cement has been extensively used heretofore. Decomposed coral provides the raw material. Natural gas will be used as fuel.

Owned by the Cia. Bahaiana de Cimento Portland, the plant will cost a total of \$4,580,000 when completed.

Brazilian cement production last year was 1,281,000 metric tons.

Ontario May Be Source of Crude Oil Soon

Ottawa—Southern Ontario may provide new sources of oil. While it is not believed there will be oil strikes as extensive as the great oil fields of western Canada, Southern Ontario is definitely in the oil bearing field, it is learned here. Oil companies are said to be looking into the possibilities and are seeking the aid of officials here.

Stratigraphical studies will be made in Southern Ontario this summer by B. A. Liberty and in the vicinity of Niagara by T. E. Bolton.

Western Powers Ease Controls In Germany

Frankfurt—Except for products that can be used only for military purposes, control of the West German chemical industry has been turned back to the Germans by the western high commissioners. The manufacture of some "war" chemicals that also have peacetime uses will be allowed.

New regulations were issued by the commissioners under a recent law to prevent German re-armament and to insure the industrial demilitarization of Germany.

The regulation covering chemi-



cals "leaves the entire field of chemical industry and products free of control" except for particular product. For example, war explosives, certain rocket fuel chemicals and poison war gases without peacetime uses will remain under control.

But the West German government was authorized to allow the manufacture of many "war" chemicals that also are required for a peacetime economy. These include industrial explosives, liquid oxygen, white phosphorus and ammunition for civil security and for sporting purposes.

Greece Stops Its Naphthalene Imports

Athens—The Ministry of National Economy has forbidden further imports of naphthalene into Greece, except for obligations already accepted. This decision has been taken because at least half the foreign exchange required for the import of pure naphthalene will be saved by the importation of only the materials necessary for local production.

Canadian Industries Will Make Explosives in Alberta

Ottawa — Canadian Industries Ltd. has acquired 1,200 acres of land about 8 mi. south of Calgary in Alberta area of Canada for the purpose of erecting a commercial explosives plant costing between \$3,000,000 and \$4,000,000. It will supply the rapidly expanding oil and raineral industries in Alberta and the Northwest territories.

Austria and Brazil Make Chemical Barter Deal

Rio de Janeiro—Austria will ship Brazil more than \$1 million in chemical industry products under (Continued on p. 225)

Editorial Viewpoints

"Replete With Commitments"

Manufacturing Chemists' Association has submitted a brief to the Congress and has ably presented by appearance one basic reason against the ratification by Congress of the Havana Charter. This would commit the United States to membership in International Trade Organization of United Nations. Other industries might appropriately study this problem from the point of view which is so well spotlighted by the M.C.A. argument.

By joining ITO the United States could either accept the proposed Charter in good faith, or could offer "lip-service" to it in the thoroughly reprehensible fashion of irresponsible international relations. We know that the American people do not favor the latter semblance of accepting without intention of real support. Any action which is taken by the Congress should be taken with sincerity and with the intent to carry out the direct and the clearly implied commitments. Hence, it is desirable for all of us to note carefully what these commitments are.

Essentially the concept of the Havana Charter is a joining of nations in a program to increase world trade in goods. But the Charter itself goes much further than that. We note a few of the points which MCA justifiably spotlights.

As drafted in the Charter, ITO is intended to do many other things. Here are a few: "to assure a large and steadily growing volume of real income and effective demand," "to increase the production, consumption, and exchange of goods," "to foster and assist industrial and general economic development," "to achieve and maintain full and productive employment," and "to facilitate an equitable distribution of skills, arts, technology, materials and equipment with due regard to the needs of its members."

In other words all this means that the United States would agree to adjust its economy to meet the wishes of the rest of the world. Regardless of what that would do to our economy, we would be compelled to assist the other nations in their general economic development. If we did not make the necessary financial sacrifice, or accept any other drain on our own economy to meet these ends, we could, and undoubtedly would, be charged with bad faith in our agreement.

The objectives sought by our representatives at

Havana are unquestionably sound. But our spokesmen made commitments there which are neither safe for America nor constructive for the world. They accepted responsibilities for the United States which they neither understood nor can explain. Congress is now identifying some of them and demanding a clearer interpretation. But it is neither decent nor honest to assume that the so-called "escape clauses" justify us in taking on the appearance of commitments when we have no intention of carrying out the promises made.

It is time we present a realistic approach on what America can do and will do for world welfare—one that can be defined and accepted as a basis of international relations. We make only enemies by insincere diplomatic blundering.

Barter for Benzene?

America needs more benzene, and promptly. Despite radical adjustments to secure a maximum yield of synthetic rubber from a limited supply of styrene, the need continues. New sources of production from petroleum and other raw materials are being developed. Ultimately they will bring us a generous supply of this extremely important raw material. But despite all this effort, we shall be for some months to come short of benzene for plastics, for rubber, and for a multitude of other urgent needs.

One source not adequately being used appears to be the European motor-benzol supply. Both in Britain and on the Continent considerable quantities of this coal chemical are consumed regularly in motor cars. Plans are underway whereby this source can be tapped to the mutual advantage of both European users and American chemical enterprise.

Benzene is used abroad in this way because in the past it has been much cheaper as a motor fuel than the equivalent quantity of high quality gasoline. It appears that this price relationship has now changed. Furthermore, at least one American oil company has been permitted to sell its products to Britain in pounds sterling. Thus it appears quite likely that this petroleum enterprise could take high quality fuel to Europe and trade it for benzene with a real margin of profit for both present benzene users and the petroleum industry.

The desirable characteristics of special gasoline so

used would readily be adjustable to the practical considerations of continental car operation. Certainly the cost of moving the motor fuel from America to Europe and bringing the benzene back is far less than the spread between the present prices of the two commodities.

The nice thing about such a trade is that it requires no new investment. Hence, it can go on just as long as it is profitable. And the new practice can be interrupted at any appropriate time without writing off new plant facilities either here or abroad.

RFC's Proud Record

Congress has been reviewing the activities of Reconstruction Finance Corp. which was created in 1932 under a Republican administration. The 18 years of operation of this government banking agency, as recently presented to the Senate Banking Committee by the RFC chairman, contained facts that we all should ponder.

Reconstruction Finance Corp. has made many billions of dollars of loans with an operating net profit of about \$560 million. This profit came after paying all expenses of operation, including salaries, interest to the treasury, and all indirect expenses. Actually, the Treasury received \$308 million as dividends; and the capital advanced to RFC has practically all been returned to the treasury. "The operations of the corporation have not cost the taxpayer a single penny," said Chairman Harley Hise.

These facts are particularly important just now when it appears that Congress is going to approve the transfer of RFC to the Department of Commerce. It makes one wonder whether any Secretary of Commerce, present or prospective, is going to be so successful in running an emergency loan business as has the board of RFC. We doubt it. But if the transfer is made we hope that all future secretaries will let the board continue to operate as prudent bankers who are responsible to the American people.

Infringement Again Defined

Repeatedly chemical industry struggles with the question of patent infringement. One of the major difficulties is that a desired end can often be reached both by a patented procedure and by a variation which is not patented. Some courts view this alternate route as open. Others regard pursuit of that route as an infringement of the main patent.

Not often do we get a clean-cut and binding court decision on this question. But on May 29 the Supreme Court of the United States gave us a sharp and reasonable definition which will probably govern in many lower courts from now on. This decision was given in a case in which the issue had to do with using a strictly defined flux in welding or an alternate material which

was not specifically mentioned in the patent in question.

The Supreme Court applied again "the doctrine of equivalents." It stated that "though infringement was not literal, the changes which avoid literal infringement are colorable only." It enunciates the principle again that one does not escape infringement by mere use of an alternate composition or an alternate procedure which does not vary substantially from the disclosure or the specific claims of a patent.

This seems to give new strength and support to our old basic idea, namely, that one does not escape the penalty of infringement by using a disclosure of a patent and slightly varying its exact and rigid specifications to achieve a desired result. The Supreme Court's decision will strengthen patents substantially if this interpretation prevails generally in the trial courts throughout the country.

A. H. Winheim, 1906-1950

The American Leather Chemists Association had just concluded its annual meeting at French Lick, Ind. Ade Winheim, who had just rounded out a brilliant two-year term as its president, got in his car and started toward his home in Missouri. With him was his lifemate who had shared so many of his trials and triumphs. Then came the fatal accident that cost Ade's life. Mildred was seriously injured but bravely carries on from her hospital in St. Louis. Their great teamwork that meant so much to so many comes to an end. But their friends can and must make sure that the things Ade Winheim did and believed in shall continue to inspire those who follow in his footsteps.

Ade packed a lot of achievements into his short busy life. In high school he edited the school paper, was on the baseball and debating teams and led his class with a scholastic average of 96. He won a fouryear scholarship at Washington University from which he graduated in 1927 with high honors in chemical engineering. Again he led his classmates in extracurricular activities.

Winheim's great interest in the outdoors took him to Alaska for his first job—capturing, tanning and dyeing sealskins. Back in St. Louis he came in 1931 to work for International Shoe Co. and in five years became its chief chemist. Then followed a dozen fruitful years of important research, the invention of the Winheim-Doherty tanning and finishing processes and, finally, in 1948 to his own company to manufacture leather chemicals and to continue research and development.

Would it not be appropriate for those of us who were Ade Winheim's friends and admirers to join in some lasting tribute to his memory? Might there not be an annual scholarship or prize established in his name which would remind future generations of chemical engineers that Ade Winheim made a real contribution to our profession.

How to Cut Costs—14 Practical Tips

These tips on cost reduction in processing plants have helped others. They should help you keep profits up.

MARSHALL SITTIG

1-Make a material balance

One of the most useful tools in reducing costs in the chemical process industries is the use of that old standby -the material balance. A plant office often will carry a raw material consumption figure on its books figured in only one way-perhaps by billed railroad car weights. A check on actual consumption at the point of addition may be quite illuminating. A fur-ther check on actual process requirements at this point, confirmed perhaps by an excess of material in ditched residue or wash water, will completely answer the question-"Is every pound paid for doing a useful job insofar as possible?"

EXAMPLE—In a pulp bleaching operation, office records showed a consumption of almost 100 lb. of a bleaching agent per ton of cellulose but plant log sheets indicated a little more than 50 lb. being added to every ton of cellulose. The plant figures simply reflected the standard figures which the operators had been recording, although they had actually been adding a much larger amount. Detailed investigation showed that a saving of 30 lb. of bleach, roughly worth 60c., was possible on every ton. Based on a production of 1,000 tons per month, this item alone yielded savings of \$7,200 per year (enough to pay the cost-reduction engineer's salary at least!).

2—Check operating standards

A second approach to cost reduction lies in the comparison of operating standards in the plant in question with other plants' data. When a company conducts the same operation in two places, a comparison may be made, allowing for whatever differences exist. When that approach is not possible, trade associations may be able to furnish average figures for the industry.

EXAMPLE-In comparison of a

Marshall String is a chemical engineer with wide experience in chemical and processing plants. He has had about ten years experience in cost reduction work. two-stage bleaching process in one mill with a single-stage process in another mill, it was discovered that one mill used almost three times as much bleach as the other mill per ton of pulp bleached. After allowing for process differences, most of this difference remained as an unexplained discrepancy. Here 100 lb. of bleach, worth roughly \$2.00 might be saved on every ton. Based on a production of 1,000 tons per month, this represents a saving of \$24,000 per year.

3-Check process efficiency

A re-examination of operating standards in terms of throughput for a given piece of equipment in barrels per day, or in terms of pounds of reagent added per ton of product, is a third step. Such operating standards may be wasteful for one of various reasons. They may have been set up in wartime or another boom production period and may represent maximum production but not maximum conomy. They may not reflect modern techniques; even though set up in the past with savings in mind, they may not represent all that can be done with improved instrumentation.

EXAMPLE—There is a tendency of the design engineer to be over-cautious. An example is that of a fluid catalytic cracking unit in aviation gasoline operation whose production was increased from 16,400 bbl. per day in August 1944 to 28,000 bbl. per day in June 1945 with consequent reduction in cost per unit product.

4—Cut careless waste with instrumentation

Instrumentation is a fourth inlet to lower costs. Chart records from recording instruments are invaluable checks on how many inches of caustic Jones added at 4 A.M. to the batch that went bad—and other similar questions. Another indirect benefit resulting from instrumenting operations, particularly in older, less highly engineered plants is the psychological value of such instruments. Instances have been noted where no change in process was made but where raw mate-

rial consumption decreased as soon as level recorders were installed on the raw material metering tanks. One shrewd old veteran asked, as mechanics were piping up the recorders, "What's that? A lie detector?" and decreased consumption figures indicated that the operators had been putting in a little extra for good measure over a period of years prior to this investigation.

EXAMPLE—In the first example cited above, the solution to the problem was finally provided by installation of two liquid level recorders at a cost, including installation, of perhaps \$300. Thus, in one year, \$7,200 was saved on a \$300 investment—a 2,400 percent return on the money invested!

5—Set up equipment operating records in writing

Establishment of equipment operating records, where they do not exist, is a fifth method of cost reduction. This involves two separate types of records. The first type is the record of cleanout intervals. This, of course, is a question of saving operating and maintenance labor required for solvent-washing, pickling, sand-blasting, and similar operations occasioned by the buildup of sludge, slime and polymeric deposits during operation. Analysis of the causes of these losttime operations can pay handsome dividends both in increased production and in decreased maintenance labor. The second type of record is the record of equipment replacement. Here a capital expenditure is involved aside from labor costs and lost production, as in the case where a heat exchanger bundle must be retubed.

EXAMPLE—In the manufacture of a rubber-chemical intermediate, careful study of the rate of buildup of hazardous deposits within the equipment resulted in the establishment of a set period between cleanouts. Each cleanout was then carefully planned to insure a minimum of overtime work, to insure that sandblast equipment and other necessary tools were on hand when needed with no costly delays. Estimating down-

time for this unit at \$70 per hr., a saving of \$1,000 was made on each cleanout, saving \$12,000 per year.

6—Plot operating data graphically to spot unknown correlations in processes

A sixth tool for the cost reduction engineer is graphical presentation of operating data. This sounds so simple that it might be assumed that everyone knows all about it and is using it in every way possible. Such is not the case in many plants. Production supervision can, all too easily, look at a column of figures and fail to see even a trend, much less a cyclic variation in raw material consumption with raw water temperature, for example. A book of graph sheets giving consumption figures and major operating variables by week and plotted on the same horizontal time scale can point out trends and variations.

EXAMPLE—A correlation between the combined SO₃ content of the cooking acid in a sulphate process plant and the amount of makeup sulphur burned was pointed out to operations men as a result of graphical interpretation of data. It was shown that a saving of 25 lb. of sulphur per ton of pulp was possible. Assuming 1,000 tons of monthly pulp production, this is a saving of \$3,000 per year.

7—Eliminate wasteful sampling by control units

A critical examination of sampling techniques presents a seventh approach to lower production costs. The size of samples is a little-considered waste. The plant laboratory may possibly be taking a pint sample three times a day, analyzing 10 cc. and pouring the rest down the drain. This gives a waste figure approaching a half a ton every year for this single process sample. It is the composite of many such economies, each seemingly negligible in itself, that makes the difference between poor and good cost performance.

EXAMPLE—A specific example can be cited of the sampling of a high-priced metal salt catalyst in a hydrocarbon polymerization reaction. Here, as described above, a half-ton a year was being wasted. At a material cost of 50 c. per Ib., this item represents 5500 per year.

8—Consider making solutions more concentrated

An eighth approach to savings is through the medium of increased solution concentrations. This is applicable to the conveyance of fluids in trucks, barges and tank cars. Often the same tank volume may accommodate enough extra pounds by a slight increase in solution concentration to make possible the elimination of an occasional trip with resultant savings in labor and in wear and tear on transportation equipment. Similarly, storage equipment can do extra duty if pumping equipment will permit.

EXAMPLE—A classical example of savings resulting from increased solution concentrations is the use of strong cooking acid in the manufacture of Sulphite pulp. Some recent figures on a Russian pulp mill indicate that an increase in total SO₆ content of the cooking acid from 5.0 to 7.6 percent effected a saving of 60 lb. of pyrites per ton of pulp, 40 lb. of limestone, 9 lb. of chlorine, plus savings in heat, water, and in increased output from the same equipment volume.

9—Recheck past employee suggestions

Approach number nine to lowered costs involves rechecking of past employee ideas. This is closely allied to the third approach suggested above—that of re-examination of operating standards. This ninth item involves a re-evaluation of employee suggestion box items—perhaps discarded in past periods when maximum economy was not the watchword. It involves a critical evaluation of mechanical job orders by the cost reduction engineer.

EXAMPLE—A piece of drying equipment was plagued by intermittent operation. No investigation was made of the true cause of the down-time but it was simply blamed on the fact that the feed was of different quality than that fed to similar machines which ran smoothly. Investigation revealed that three years previously an order had been put in to change some corroded press rolls. Replacement of these rolls made operation virtually trouble-free.

10—Make a time study of plant operators

A tenth approach to lower costs, perhaps the most fruitful, is also the most distasteful to many chemical engineers. That is the time study of plant operators to see whether they are doing eight hours work for eight hours pay. Cost reduction through chemical control requires constant vigilance but once six men are doing

the work that seven formerly did, the chances are that they will continue to do so and one man's wages are clearly and definitely saved. The comparison of operating standards, the second technique outlined above, may be applicable here if data on man hours per ton for a comparable operation are available.

EXAMPLE—Comparison of operating crews in two plants making similar products revealed that, for example, three operators plus three helpers were getting out less production than three operators alone in the other plant. Here this simple comparison permitted a definite and continuing saving of \$10,000 per year.

11—Get maximum work from all research and pilot plant equipment

Economy in research may be listed as technique number eleven. Overall research budgets have always been subjected to careful scrutiny but a breakdown of research expenditures has rarely gotten the "going over" that plant operating costs have. Research is more or less of an intangible compared to the realities of manufacturing. Today, however, standardized components of pilot plant equipment, minimization of pilot plant expenditures by maximum application of reaction kinetics to bench-scale data, etc. have done much to lower research costs.

EXAMPLE—An example may be quoted of published results of industrial research on an improved metal casting process wherein a research investment of \$3,600 produced cost savings in excess of \$26,000 in a single year.

12—Improve safety practices to cut down losses

Savings through safety education represent the twelfth technique for economy in industry. Effort expended on industrial safety pays dividends: the efforts of the Atomic Energy Commission and of Du Pont will show. Lost time due to accidents averaged 1.44 (time-losing injuries per million man hours worked) in all Du Pont plants during the war years and was less than 3.0 in all manufacturing operations of the Atomic Energy Commission in 1949. Both of these organizations have been outstanding for their emphasis on safe practices.

EXAMPLE—The Seventh Semin-

nual Report of the Atomic Energy Commission cites loss ratio figures in cents per \$100 worth of property. Atomic Energy Commission fire losses were 3.2 in 1945 and have steadily decreased to 0.8 in 1948 (as against a 10-year national average for all industry of 15).

13—Prepare loss reports for materials lost in processing

Strict accounting for material losses in processing is a thirteenth road to lowest-cost operation. A loss report which must be turned in to management for all material losses in excess of a certain amount (say \$100) represents a powerful deterrent to the practice of "ditching" a bad batch.

EXAMPLE—Loss of a liquid catalyst from a polymerization reactor in a large organic chemicals plant made turning in of such a loss report necessary. Operating supervision then held a meeting at the superintendent's request and substituted a flanged valve, bolted to the reactor, for a screwed valve which had accidentally come unscrewed during dismantling of auxiliary piping and had caused the loss of a reactor-full of catalyst valued at several hundred dollars.

14—Write up modern operating procedures for operators

The fourteenth approach to cost reduction lies in the utilization of written operating procedures. This imposes a burden on the operating supervisor who, with the cooperation of the foremen, must prepare such a "bible." Such a manual, constantly revised to reflect the latest changes in procedure, is invaluable however. The "father-to-son" oral transmission of operating instructions is still practiced in some cases. The aggressive, progressive organizations, however, don't say it—they write it.

EXAMPLE-In the conduct of the cleanouts mentioned in the fifth example above, a detailed operating manual was made up covering the points of inspection. In addition, special sheets were made up for each individual cleanout, reminding the operators of lines which gave evidence of plugging during the month past. and of other items whose omission through forgetfulness would cost money during the coming month in improper operation or in the form of a special, premature cleanout. Written systems resulted in decreasing down time by 20 hours at a saving of \$1,400 per month.

Specialists Can Make These Tips Work

The regular line organization of production supervision is often so pressed with run-of-the-mill production problems that its members simply cannot take time to assume a proper perspective of the cost problem. Thus, a separate team must be assigned to the job. Two fundamental questions are raised (1) where to get the men and (2) what backgrounds they should possess.

PICK A TEAM

The primary choice involved in picking the source of this team are (1) outside management consultants or (2) men from within the organization. The size of the organization may eliminate the choice a small organization having no alternative but to go outside the organization. Where a choice exists, each alternative has some points in its favor. The tag of efficiency experts" (spoken with the same inflection used for "damyankees") is particularly quick to be applied to outside men, but the relatively impersonal nature of such people has its advantages. People picked from within the organization may be able to capitalize upon prior acquaintances but they may equally well alienate these acquaintances on the new assignment. This problem is solved in a large organization by a transfer to another plant. A small organization might do well to hire outside help.

TWO CHOICES

The desired background of the engineers assigned to the job presents another problem. Assume that we are going to overhaul the operations of a tannery. On one hand we might favor a man or group of men who have familiarity with all types of leathers, tanning agents, and tanning techniques. On the other hand, some favor the "fresh" approach wherein one or more individuals with a sound engineering background but no specific background in (and hence no preconceived notions about) the particular operation to be studied. The optimum would be a man or men open to suggestion and eager to apply new concepts but with some knowledge of the industry as

a whole to provide some bench marks of performance as a guide.

WORKING TOOLS

Cost reduction teams must have management backing. This must consist of sincere understanding and endorsement on the part of top management—not merely lip service in an effort to salve their own consciences.

The cost reduction teams also must be equipped with supervisory cooperation. This has a dual source. Naturally, the fair and honest conduct of the investigators will go far to build up this attitude in supervision. However, some department heads may be resentful of intrusion and appear deaf to overtures on the part of the teams. Here, management backing should act to give these men a chance to present their case and to have it fairly evaluated.

The third item which must be provided for the investigators by management is access to all cost, production, and labor records of the organization. This gives these men more information than many executives would care to have divulged but maximum results can be obtained only by complete frankness.

PROBLEMS ENCOUNTERED

Cost reduction is far from an easy job, aside from the technical problems encountered. It embodies elements which can lead to friction with virtually everybody in an organization. As an associate once put it, "It's a combination of the United Nations and the FBI."

Management may resent exposures of wasteful practices which have been permitted to exist under their very noses for years.

The workers will resent the presence of the "efficiency experts" mainly because of fear of losing their jobs.

A problem in those organizations which are not basically engineering-minded is getting the story across to members of the executive staff. Skillful report writing with graphic illustrations of problems and proposed solutions are needed here. In spite of such aids, this is a stony road to travel.

THE FLUOROCARBONS

Everybody talks about the fluorocarbons but hardly anyone has had a chance to do anything about them. To find out why we can't get them, when we will get them, what they will be good for—Chemical Engineering has gone to a pioneer in the field. He tells here, concisely, what the fuss is all about.

J. H. SIMONS
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QUESTIONS are currently being asked by many people about the utility of fluorocarbons and their derivatives. What are the fluorocarbons good for? When will they be available? How much will they cost? Most frequently the questions center upon the availability of a particular fluorocarbon for a particular application. These are proper questions, but they are more easily asked than answered. The fact is that only a few compounds of the enormous fluorocarbon domain have yet been made, the important methods of synthesis are yet to be discovered, costs are high, there is no pool of trained researchers, there is not enough money for fundamental research. Does that mean we should turn away in disgust? Not at all. It will take time, but good things are in the wood. Let us see as best we can what these good things

As our starting point for a trip to the future we shall take our present knowledge about the properties of the fluorocarbons. From their properties we can tell fairly well what to expect of them. Both the physical and chemical properties will need to be considered, and we wish to consider these for the fluorocarbons proper, fluorocarbons containing functional groups, and for molecules of carbonaceous structures containing fluorocarbon radicals.

Chemically stable to 500 C.

The fluorocarbons themselves are highly resistant to chemical attack and are thermally very stable. Carbon tetrafluoride is thermally stable up to about 1,100 deg. C., begins to have a detectable rate of reaction with water only

at about 850 deg. C., and reacts with the alkali metals only at temperatures in the neighborhood of 400 deg. C. and above. Fluorocarbons containing carbon bonds are less resistant than this to chemical action, because they tend to react by rupture of the carbon-carbon bond. But even these reactions usually occur only at about 550 deg. C. There are two reasons for this low reactivity, thermodynamic stability and low rate of reaction. The latter is due to the compactness of structure which insures a low rate for even those reactions that are thermo-dynamically highly favored. To compare the fluorocarbons with the hydrocarbons we see that the hydrocarbons have a permanency at room temperature despite the fact that most of them are thermodynamically unstable in regard to their elements or simpler hydrocarbons. This permanency is provided only by a relatively high energy of activation. Under conditions of lower energy of activation, i.e., providing suitable cracking catalysts, detectable decomposition is observed readily at room temperature. With the fluorocarbons the thermodynamic situation is much more favorable for stability of the molecule, so that stability at room temperature would be expected even with a low energy of activation. However, the compactness of structures provides the fluorocarbons with even a higher energy of activation for most reactions than is observed in most hydrocarbons. We can, therefore, expect fluorocarbons to resist most chemical action up to about 500 deg. C. This sitnation is true for most reactants regardless of whether they are oxidizing or reducing agents or whether they are acidic or basic.

This resistance to chemical attack by the here to fluorocarbons is preserved by fluorocarbon radicals, when these are attached to functional groups or to molecules that are not otherwise fluorocarbon. In some cases the carbon atom adjacent to the nonfluorocarbon part of the molecule is more reactive than the remainder of the radical and, in certain reactions, is subject to the loss of fluorine atoms. In general, however, the fluorocarbon radical on a molecule is quite resistant to attack. Compare, for example, the ease of hydrolysis of benzotrichloride with the resistance to hydrolysis of benzotrifluoride. The methforyl radical on the benzene ring also provides resistance to oxidation of the ring. The oxidation of benzotrifluoride is accomplished only with extreme difficulty. This particular property has been beneficially employed in certain dyestuffs. A considerable amount of fading of dye is caused by photochemical oxidation. Methforyl groups in this type of dye molecule provide resistance to oxidation and increases dye fastness. If this property is a general one, and it appears to be, then the inclusion of a fluorocarbon radical in a molecule will provide a group which is both highly resistant to reaction and also increases the resistance to reaction of the entire molecule. The work in

this direction promises significant progress. In molecules of fluorocarbon derivatives, i.e., judge molecules that are essentially fluorocarbon but contain functional or nonfunctional groupings enalogs of atoms other than carbon and fluorine, the properties are considerably different from the analogs of these compounds in organic chemistry. For example, the fluorocarbon carboxylic acids are very much more strongly acidic than the corresponding organic acids. Physical properties also show considerable difference. example, the dielectric constant of trifluoroacetic acid is very much higher than acetic acid. some five times; and it exhibits the very unusual property of increasing with temperature over a very considerable temperature range. A molecule consisting of two fluorocarbon radicals attached to an oxygen atom, i.e., a fluorocarbon oxide, exhibits none of the properties characteristic to the analogous organic compound, analiphatic ether. It shows none of the characteristics of solubility. It is neither a good solvent for acidic substances, nor is it split by the usual techniques available for the splitting of organic ethers. In the same way the fluorocarbon nitrides (compounds in which three fluorocarbon radicals are attached to a nitrogen atom) exhibit none of the characteristic properties of aliphatic triamines. For example they show no basic characteristics. Hydroxy fluorocarbons, which would be analogous to alcohols, have not as yet been prepared, although attempts have been made to do so. This probably indicates a relatively low stability due to a tendency for the splitting of bydrogen fluoride. Compounds in which the hydroxy group is insulated from the fluoroearbon radical by a CH, group have been made and show much higher acidity than the corresponding organic alcohol. A fluoroxy compound has been made, however, the analog of which is not possible among organic compounds.

Because of the stress of wartime conditions Beware under which a considerable amount of the now obtainable information was secured and also be. deta cause of the fact that new methods of preparation and purifications are required, some of the chemical data now available relative to fluorocarbons is misleading. A considerable part of this is due to minor impurities in the fluorocarbons. The fluorocarbons are so much more resistant to chemical action than most impurities that these give chemical characteristics to the mixture which are quite different from those of pure fluorocarbons. Let us suppose we have a sample of material which was purported to be C.F. If the bottle contained C.F. H, the hydrogen content would be slightly less than 0.25 percent. If the material, however, were 99 percent C₈F₁₀ and 1 percent C₈F₁₀H, the hydrogen percentage would be slightly less than 0.0025 percent. Although this would be extremely difficult to detect by analysis, it would impart considerably different properties to the mixture. If, for example, this fluorocarbon hydride were more readily hydrolyzable than the fluorocarbon itself, ordinary tests of hydrolysis would give a rather appreciable indication of reaction, for once hydrolysis on such a molecule began it would probably proceed down the carbon chain until all the fluorine of that particular molecule was converted to fluoride ion. Recently improved methods of purification enable much purer samples to be obtained, and recent work in both chemical analysis and spectrum analysis enable the purity to be estimated with greater accuracy. Earlier samples from both industrial and government sources were sufficiently impure to have properties which were misleading. Regrettably such unnecessarily impure samples are still being supplied from some sources. This is retarding the utilization of fluorocarbons by having false information in the hands of the very people who would use the materials if the correct data were available

Physical properties, pleasant surprises Bailing

It is not only for their chemical inertness and that fluorocarbons will find employment. The freezing physical properties promise many uses. The points fluorocarbons have boiling and freezing points not greatly different from hydrocarbons having the same carbon skeleton. Isomeric fluorocarbons tend to boil very nearly at the same temperature, whereas isomeric hydrocarbons show a considerable range of boiling points. Fluorocarbons with four carbon atoms in the molecule boil very nearly at the same temperature as hydrocarbons with the same number of carbon atoms. Lower boiling fluorocarbons boil higher than the analogous hydrocarbons, and higher boiling ones boil lower than the analogous hydrocarbons. This difference in boiling points increases for analogous compounds with increasing number of carbon atoms such that CaFie boils about 20 deg. below n-octane. Because of the low boiling points for their molecular weights, the fluorocarbons provide vapors of extremely high density. The above-mentioned compound with a molecular weight of 438 boils at 104 deg. C. Even more surprising, the fluo-

". . . who will pay for it?"

The burden of this exposition is that highly desired utilitarian products appear possible from the fluorocarbon domain. The knowledge in this domain has not advanced to a point where we can with confidence proceed to the commercial aspects of the problems. Much and very costly development work is yet to be initiated. Still more important we need the fundamental new knowledge that can only be obtained from basic and fundamental research. By this latter term I mean that kind of research which the industrial companies and the government laboratories both say does not come within their scope. It is not sufficiently practical; it should be done by the university. In all sincerity I ask, who will pay for it? The industrial companies say the government. The government says the universities. The universities say we're broke and can't; the individual will have to pay for it, if he desires to do it. Under present conditions the individual in the university simply cannot do it. His obligations are too great and his financial resources too small for him to even consider

such matters. There are at present many too many government sponsored research projects in the universities, and the research man must engage in these in order to provide funds for the overhead for the institutions.

There is no source of funds in view for progressing in new fields or in new directions. Progress will be made along these lines despite this fact, but it will be slow, very painfully slow. It will come about as in the past by individuals with an urge for science and new knowledge creating the necessary sparks and performing the necessary labors in what otherwise would be time for relaxation. They will also extract a small amount of the necessary facilities and time from their important obligated duties and from the sponsored, directed, and financed programs. In other words, they will bootleg just a little of those things that are available to provide values for society im-mensely greater than those regulated activities from which they were bootlegged.

-1. H. Simons

rocarbon oxide, (C.F.),O, molecular weight 454, boils at 101 deg. C.

The fluorocarbons are very transparent substances having apparently no absorption bonds in the visible. The refractive indexes are gen-erally below 1.3. This property, of course, is indexes subject to variations due to structure and the presence of substituents. It can be used for purposes of identification in the same way that

it is used in organic chemistry.

Refractive

Viscosities

Salubilities

The fluorocarbons have viscosities usually not greatly different from hydrocarbons of the same carbon structure. In fact, for most fluorocarbons the viscosity is either higher or lower than the corresponding hydrocarbon depending upon the units of viscosity and the temperature.

A property of the fluorocarbon that is very

Surface feasions striking is the extremely low surface tension. Liquid fluorocarbons have surface tension about as low as any known liquid in the same boiling ranges. This property alone may be the reason for the employment of fluorocarbons for a

great number of important purposes.

An unexpected physical property of the fluorocarbons occurs in the solubility relations between fluorocarbons and hydrocarbons. Two substances of the same boiling point, of the same zero dielectric constant, of practically the same polarizability, and of the same carbon skeleton structures might be expected to be ideally soluble one in the other. A fluorocarbon and a hydrocarbon fitting the above specifications form solutions which are very far from ideal. In fact, the separation into two liquid phases not far below the boiling point can be expected. This particular solubility behavior when considering all compounds in the fluorocarbon domain provides a body of solvents with new properties which may be significant in regard to extraction and similar problems.

The lesser solubility of fluorocarbons for organic substances than equivalent organic solvents, the low solubility for water, and the low surface tension together impart to the fluorocarbons a rather unique situation in regard to adhesion to other substances. Extreme difficulty has been found in obtaining substances that would adhere to solid fluorocarbons. This property would provide to any surface composed of fluorocarbon molecules a unique property of nonstickiness or extreme ease of cleaning.

Compounds compounded

As fluorocarbons of almost any number of Atoms carbon atoms and almost any skeleton structure will probably be forthcoming as well as the host of derivatives in numerous homologous series, it can be expected that gases, liquids, and solids of a host of physical properties can and will be prepared. The mere fact that a particular substance composed of fluorocarbons with a certain desired set of properties is not at present available is no indication that it is impossible of attainment or that given sufficient stimulation it cannot be obtained within a reasonable period of time.

The number of known chemical compounds Com in the fluorocarbon domain that have been prepared and identified is being added to daily at such a rapid rate that no reliable estimate of this number can be given. It is probably in the order of magnitude of one thousand as of the time of writing, but that number can be expected to be far outdistanced before this exposition is cold. We can, however, at this time see the outlines of what is to be, and a brief preview may be in order to whet the appetite of the prospective user.

Of the compounds of carbon and fluorine Series alone, i.e., the fluorocarbon proper, we now know of members of many series. Chain compounds have been prepared in significant numbers with the chains either straight or branched and cyclic compounds containing rings of four, five, and six members as well as compounds con-

the like. From this, it can be confidently predicted that all the variety of skeleton structures present in hydrocarbons are possible for fluorocarbons, and due to their greater stability, fluoro-

taining fused rings, rings with side chains, and

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carbons of skeletons structures not available in hydrocarbons will be forthcoming. Compounds containing less than the number of fluorine atoms required to satisfy the valence demands of the carbon atoms have also been made. Although the name may be misleading, we might call these olefinic or unsaturated fluorocarbons. The lowest member of these substances, the one with only two carbon atoms, shows the characteristic olefinic properties of the addition of bromine, polymerization, and condensation with a variety of substances. As the number of carbon atoms increases, however, these properties decrease rapidly. Although some of the techniques available for reactions of organic unsaturated compounds may be denied us, we hope to invent new and equally useful techniques for fluorocarbons of this kind. Until we do so, however, we may not even be able to characterize such compounds by chemical means, and we will have to rely upon physical deter-

minations for identification.

Reactive

wasi unreactive Fluorocarbon derivatives are now being made in significant numbers. These occur in two classes: those that are reactive and those that are relatively unreactive. We can mention the fluorocarbon hydrides, chlorides, oxides, and nitrides for characterizing the properties of these latter compounds. Let us consider those containing only one atom in the molecule of the above-mentioned elements. The fluorocarbon hydrides are very nearly as stable and unreactive as the fluorocarbons themselves. For the same carbon skeleton the monohydride boils higher than the fluorocarbon proper and has a higher refractive index, a higher dielectric constant, a tendency to hydrolyze and react with chlorine and bromine much greater than a fluorocarbon. The fluorocarbon monochlorides are not quite as stable and unreactive as the fluorocarbons, but attempts to use the chlorine atom as a point of chemical attack for useful synthesis have so far been unsuccessful. Compounds of this kind show no advantages over the fluorocarbons in any significant properties but have some disadvantages. Fluorocarbon oxides have thermal stabilities that approach those of the fluorocarbons. Higher members of this series have boiling points even lower than fluorocarbons of the same number of carbon atoms despite the higher molecular weight. As they show none of the usual chemical reactions of organic ethers, their uses will probably be very similar to those of fluorocarbons. The fluorocarbon nitrides seem related to the fluorocarbon oxides and approach them in stability. These four relatively mert derivatives provide an opportunity of compounding mixtures with fluorocarbons to provide inert substance having a range of properties.

Fluorocarbon derivatives containing funcgroups tional groups of considerable reactivity are beginning to be prepared in significant numbers. We can mention fluorocarbon bromides, fluoro-, carbon iodides, fluorocarbon carboxylic acids, and a fluoroxy fluorocarbon. The properties of these substances have only begun to be studied. Although the Grignard reaction appears possible for some of the fluorocarbon halides, either major modification or drastic change will have

to be made in this type of reaction before it can be put to general use. The same statement is probably true for all organic chemical methods, and it seems reasonable that an entirely new set of reactions will eventually be evolved to carry on synthetic chemistry in the fluoro-

carbon domain.

Organic compounds containing fluorocarbon Redical radicals have been made in fair numbers. With provps new fluorocarbons containing functional groups being available we can expect this field to expand rapidly. The substances so produced will find employment in places where the extreme properties of the fluorocarbons are not required but only modification of the organic compound. As the organic part of these molecules will still undergo most of the organic chemical reactions with only slight modification, these substances can be put into use more rapidly than the entirely new class of substances in the fluorocarbon domain. Up to the present only the methforyl group has been available for use in organic molecules. Recent work gives promise of providing other fluorocarbon radicals for such uses.

How to make fluorocarbons

The methods of synthesis of the fluorocar- New bons and their immediate derivatives are dras- methods tically different from those of hydrocarbons. Chronologically, the first method was a reaction between the elements. At first only CF, was identified from such a reaction, and explosions almost invariably resulted. Changes in technique and considerable experimental work have shown that large quantities of fluorocarbons can be made by this procedure. There are no obvious reasons why improvement in technique cannot reduce the percentage of CF, to ever lower values. At present somewhat less than 35 percent has been achieved. When the fluorocarbons have general employment in all boiling ranges this may be a commercially feasible process, because high boiling condensed ring structures are made by this method that may be extremely difficult to make otherwise; and the process makes more efficient use of fluorine than any other process that employs the free element. The electrochemical process has been sufficiently developed, so that confidence can now be placed in its general utility. High yields of specific substances, either fluorocarbons or fluorocarbon derivatives, can be readily made in one step by this process. This gives us assurance of a ready supply of raw materials in both quantity and variety as rapidly as there is a demand for them. The chemical reaction and synthetic methods of fluorocarbons already known and being currently discovered insure ability to convert the fluorocarbon raw materials produced by the electrochemical process into all the multitudinous finished products that may be required.

How to use fluorocarbons

Because of the great difference between the Not submembers of the fluorocarbon domain and stitutes compounds in any other branch of chemistry,

Functional

". . . analogy, becomes useless."

Lest people become too impatient, it may be well to reflect as to why their particular fluorocarbon plastic or lubricant is not immediately available at their favorite supply house. The very fact that the domain is so extensive is in itself a reason that time will be required. Before many of the intriguing new materials will become available a great amount of fundamental research is necessary. Our needs are new knowledge, new methods of synthesis, and new theoretical points of view. One of the primary reasons for slowness is the fact that there has not been enough time to train the many people needed to carry on this research. It may be argued that we train many chem-

ists-why can't they do this work as well as anything else? Perhaps they should, but the results of experience show otherwise. Organic chemists are people trained with the points of view and the methods useful in organic chemistry. And it can be shown that the properties of substances, the methods of synthesis, and the theoretical framework of the fluorocarbon domain are significantly different from the domain of organic chemistry. A chemist uses analogy in his thinking processes-a meful tool when confined to one domain. But analogy becomes useless and a positive bar to good thinking when it is used to extrapolate from one domain to another. -J. H. Sunons

it is harmful to consider the fluorocarbons as replacements or substitutes for other substances. They are new compounds with new properties for new uses, and it is important that we carefully consider the desirable properties of the substances in relation to the particular situations in which those properties may be beneficial. A few examples may be helpful. Low boiling fluorocarbons would naturally be considered for refrigeration purposes. Their detailed engineering thermodynamic properties will not be identical with presently used refrigerants so that they would not improve operating efficiencies by a one-to-one replacement in equipment designed for present refrigerants. If the fluorocarbons were to be used, optimum operating efficiency could only be had by a design based upon the thermodynamic properties of the particular fluorocarbons. Again the fluorocarbons may not be replaceable for this other refrigerant on a cost basis. The particular properties of the fluorocarbons-very high resistance to chemical action, complete lack of toxicity, resistance to destruction in a flame and when they are destroyed in a flame, the issuance of no highly toxic products-might be sufficient for certain applications to greatly counterbalance a cost differential.

To show how we may be misled about the properties of fluorocarbons, assume we are employing an aliphatic ether for a certain important purpose. The high combustibility and low flash point of this material impose undesired hazards. The thought immediately arises that a fluorocarbon ether would be just the thing for this place, and the increased cost would be compensated by lower insurance rates. The word ether to the chemist denotes certain important chemical and physical properties and when a certain fluorocarbon is called an ether, he rightly expects the material to act like one. Fluorocarbon compounds containing the same skelton structures as the aliphatic ether have unfortunately been called ethers despite the fact that they possess none of the properties which are usually considered by the chemist as characteristic of ethers. I would prefer to call such compounds fluorocarbon oxides so as not to mislead. If the usual ether properties are desired. it will be necessary to have one or more organic carbon atoms adjacent to the oxygen atom in the molecule. Such a compound may be useful

for this desired purpose-the fluorocarbon radicals reducing the danger of combustion and explosion, but the organic part providing the ethereal properties. A similar situation has also Nitride, developed in the regrettable naming of nitrogen not containing fluorocarbons as amines. I refer omine here to what I choose to call fluorocarbon nitrides, i.e., compounds in which the nitrogen atom is attached to three fluorocarbon radicals. The properties of these compounds would lead one to expect them to be derivatives of nitrogen trifluoride rather than ammonia. Calling them amines leads one to expect basic properties which they do not possess. If the properties of an organic base are desired while at the same time providing some of the desirable properties of fluorocarbons, then a similar situation results as explained above in regard to ethers.

Paint? Fabrics? Solvents? Not now but someday

Another way of considering the possible uses Picture of fluorocarbons would be to picture a type of substance that would be useful, if to it could be imparted certain of the properties of the fluoro-carbons. A good example of this is paint, var-nish, or enamel. Let us call such a material a fluorocarbon paint despite the fact the name may be actually inappropriate. From the properties of the fluorocarbons we would imagine a fluorocarbon paint to have these very desirable properties. It would be noncombustible and would greatly reduce the hazards of fire even when used on otherwise combustible materials such as wood. Due to the lack of adhesion of fluorocarbons to other substances, it would be extremely easy to clean. It would not undergo slow oxidation or deterioration due to light, insects, mold, or similar destructive agents. It would tend to preserve its color in a light fast condition. We can all agree that such properties are highly to be desired and may even be willing to admit that such a material would be worth a con-

siderably higher price.

At first glance one would say that all one needed would be a fluorocarbon resin to put into the formula of some presently available varnish. Would that it were this easy. What resin, where, and how to make it-from what. No fluorocarbon resin yet produced has the desired properties. Even if we had a resin, it is highly questionable that it would be compatible with pres-

Oxide.

other

ently used solvents and thinners. When a fluorocarbon resin is obtained, it will be necessary to make it adhere to the underlying surface but still have little adhesion for anything else. I merely cite this to show that substitution or replacement is not the path to follow. Do the questions just raised mean that the desired cannot be had? Indeed not.

One could outline the procedure of obtaining a fluorocarbon paint somewhat like this. We shall simultaneously need to develop the resins, the fillers, the pigments, the solvents, and the thinner. Each and everyone of them will need to be synthesized with a view to their particular properties and in relation to their cooperative employment with the other necessary ingredients. It would certainly be insulting to the abilities of chemists to affirm that this could not be done, and I believe that most people would agree that the ultimate value of a fluorocarbon paint would be worth the effort. Those of us with the longest experience with the fluorocarbons know full well that the basic chemistry is now unfolding that will enable all this and more to be done.

Let us take another example. Would fluorocarbon fabrics be desirable? The answer is an unqualified ves. Are they within the realm of possibility? The answer again is yes. Are they available? Regrettably no. What is needed for their attainment? That is the only easy

answer-money and patience.

There is one area of use in which the fluorocarbons can possibly find employment most quickly. This is for use as solvents and also as liquid phase medium in which to carry out chemical reactions. The desirability of having a liquid phase medium of carrying out reactions is well understood. For reactions, such as energetic oxidations, sufficiently resistant liquids are not readily available. After a sufficient amount of study is made on the solvent properties of fluorocarbons and their derivatives in all their multitudinous variations, fluorocarbon liquids can probably be provided that will help the chemical processing industry tremendously.

The fuss about fluorocarbon lubricants

An intriguing possibility for the use of fluoroadhesion carbons is for lubricants. The fact that adhesion and and cohesion are both very low would indicate good lubricating properties. The resistance to both thermal decomposition and chemical reaction would give promise of providing lubricants to withstand higher temperatures than present lubricants. The fact that a reaction analogous to the dehydrogenation reaction of hydrocarbons is not available to fluorocarbons would remove one of the major difficulties experienced with hydrocarbons, i.e., the tendency to form unsaturated compounds which subsequently polymerize to form gums. The resistance to oxidation reduces the tendency to form acidic substances that result in corrosion. Tests of fluorocarbon liquid mixtures of high boiling components have shown promise of lubrication properties. These facts would indicate that fluorocarbons could be used in machines of current design, sometimes with considerably beneficial results. For example, in addition to the above-mentioned possible advantages, a fluorocarbon liquid lubricant might be advantageous for use in internal combustion engines using hydrocarbon fuels, because of the fact that the solubility of hydrocarbons in the fluorocarbon lubricants is much less than it is in an

analogous hydrocarbon lubricant.

The most significant factor governing the use Intriguing of fluorocarbons as lubricants is, however, not possibility in the replacement of some other lubricants in a machine of current design. The intriguing possibility of fluorocarbon lubricants lies in the possibility of designing new and improved equipment taking advantage of the particular beneficial properties of the fluorocarbons. We can immediately see the possibility of the use of higher temperatures. Higher engine efficiency and economy might result. Because of the resistance to oxidation, not only is fire hazard reduced because of the combustibility of the lubricants, but also the lubricant can be used in the presence of highly oxidizing gases such as oxygen and chlorine. Air compressors, for example. need to be carefully designed so as to prohibit explosions due to combustion of the oil. Multistage compressors are employed because a low compression ratio in any one stage is necessary in order to overcome this difficulty. Fluorocarbon lubricants in such a case might have significant advantages. Again I will have to admit that special lubricants for a host of new uses, made entirely of fluorocarbons, are completely unobtainable. Our knowledge has simply not advanced to the point where we are able to produce them. One must realize that hydrocarbon lubricants, in the first place, came from very simple distillations of crude petroleum. From that point to present technology of lubricants required many years and the work of many men. For fluorocarbons we do not even have the analog of crude petroleum from which to start. Lubricants in general are complex mixtures and are not single chemical species. We are not even satisfied that we can specify the detailed hydrocarbons and their specific concentrations in the ideal hydrocarbon lubricants. Realizing that analogy between hydrocarbons and fluorocarbons is not good reasoning, it should be realized that our knowledge as to what fluorocarbons to employ and what concentrations thereof is infinitestimal. Even should that knowledge be available, the individual fluorocarbons would have to be made. That may take more than a few days. Some samples of fluorocarbon lubricants have Violent

been made by subjecting a hydrocarbon lubri- birth cant to the violent hydrogen replacement reactions employing certain metallic fluorides (CoF, and AgF,). In the first place, the violence of these reactions would necessarily produce a fluorocarbon mixture whose molecules were not identical in carbon skeletons to those of the hydrocarbon mixture. In the second place, it is purely fortuitous that a fluorocarbon mixture produced in this way would have any desirable lubricating properties at all, even though the structures were identical and in the same concentration as the hydrocarbon mixture.

Even though such a mixture were not a good lubricant, there would be no indication whatsoever that a proper fluorocarbon mixture would not be an extremely valuable lubricant.

Viscosity

It has been said that fluorocarbon lubricants would not be useful because their viscosity index is not as favorable as the best presently made hydrocarbon lubricants. This is an extremely erroneous point of view. In the first place, is is comparing a chance mixture of fluorocarbons with a highly developed hydrocarbon lubricant. In the second place, it is inferring that the same machine will be used with the same viscosity requirements. The change of the viscosity with temperatures of pure substances is usually high. Lower viscosity change with temperature is provided by making liquid mixtures of many compounds. It is highly probable, therefore, that fluorocarbon mixtures can be prepared with highly favorable viscosity indexes. It is true, as some people have pointed out, that a certain fluorocarbon of the same carbon skeleton as a hydrocarbon has a greater change of viscosity with temperature. Two things can be said in reply to this. In the first place for some of the very compounds given as examples of the above the opposite is true when taken in a different temperature range. Other fluorocarbons can quite conceivably have a temperature coefficient even less than that of the analogous hydrocarbon in all temperature ranges. Even though this were not the case, until we have exhaustive systematic study we should not make any generalizations in regard to substances not yet prepared. For the machine not yet designed to use fluorocarbon lubricants, how can it be asserted what temperature coefficient of viscosity may be demanded?

There are a variety of situations in which lubricants are used, and the lubricant actually performs more functions then merely providing a surface of low friction. Sometimes a flowing liquid lubricant is used, sometimes a nonflowing liquid or grease is used; and in some cases a low friction bearing is provided without the presence of a liquid at all. The flowing liquid lubricant can provide continuous cleaning of the bearing surface and act as a cooling device for the bearing. In many types of bearings merely replacement of the lubricant is required. In small machines flowing lubricants are seldom necessary, as the design provides sufficient metal to conduct the heat away from the bearing surface. It would seem possible for this kind of lubrication to provide solid fluorocarbon bearings provided, of course, that proper ones could be made. It would appear that the lack of adhesion to a solid fluorocarbon might enable this to be possible. In this case, viscosity index is of no significance. Even for larger bearings. this type of construction might be considered by incorporating a cooling device in the design. Whether or not friction could be adequately reduced in this manner is pure speculation. It would also seem difficult to provide a solid lowfriction surface for roller and ball bearings in the present state of development, but even this might be possible. In regard to the beneficial use of a flowing liquid lubricant for the purpose

of keeping the bearing surface clean, we can state that it is conceivable that the fluorocarbon lubricant would avoid this necessity. The foreign material that needs to be removed from the surface is either metallic particles abraded from the bearing surface or particles of decomposition of the oil itself, some of which is caused by the catalytic action of the metal on the hydrocarbon. As one can readily perceive, both of these might conceivably be reduced by the use of fluorocarbon lubricants. If the lubricant itself is not destroyed, in the bearing, its replacement is not so urgent.

Flight without fire

One of the not inconsiderable hazards of Light and aviation is the ever present possibility of fire and combusti explosion. Most airplanes are mechanical devices of relatively light construction covered for the most part with some combustible surface treatment such as paint or varnish. Highly combustible rubber is used for tires and other purposes such as the leading edges of wings. Lubricating oil is circulated through the engines to various bearing surfaces, from which it may be splashed to other parts of the machine. Liquid hydrocarbons are also used in many planes in the hydraulic system to provide the transmission of power to many parts, and this means that tubing carrying a highly combustible liquid is present in many areas of the airplane. A combustible liquid is also transported to and ejected from the propeller for descing purposes. In addition to this the hydrocarbon fuel is highly volatile and has a low flash point. It burns vigorously and on admixture with air can provide for explosions. It probably is not surprising, therefore, that fire and explosions are a considerable hazard in aviation. In view of this, perhaps the No SMOKING signs have greater significance. It is not necessary, however, that the spark be provided from tobacco. The internal combustion engine has incorporated in it an electrical device, designed particularly to provide sparks for the ignition of the hydrocarbon fuel, and sparks are difficult to avoid on collisions. If we allow our imagination full play, we can dream up an airplane in which fluorocarbons will very greatly reduce these fire hazards.

Our imaginary airplane will have no combus- Light and tible materials in its construction. No wood or combustible plastics will be used-instead, bustible where such types of materials are desired, fluorocarbon plastics as yet not created will be employed. We can have confidence that plastics of all types of physical properties can and will be made from fluorocarbons. Instead of rubber for the tires and for the leading edges of the wings, fluorocarbon elastomers will be used. It has already been demonstrated that fluorocarbon clastomers are possible, but a great deal of further research will be needed in order to get them in a convenient price range. Where fabrics are desired, combustible ones will be replaced with either glass or as yet undeveloped fluorocarbons. Fluorocarbon liquids will replace oil in the hydraulic system. This is one place where our present knowledge insures us that

Propollers

sary in order to provide the proper material. It is true that perhaps it may be necessary to make some changes in the mechanical equipment, but at present these appear to be only minor modifications. In all probability the propeller will have either a fluorocarbon surface of some kind or will have fluorocarbons provided in some way to serve for deicing purposes. The fluoro-carbons' low compatibility for water would in-dicate that they would be superior materials for such purposes. The added advantage of lack of combustibility makes their investigation for Paints such purposes most impelling. Where surface coatings are required it appears obvious that the above-mentioned fluorocarbon paint would be specified. Even if a combustible oil were accidentally splashed on such a surface, it would not be absorbed and would be easily removed.

only a little further development work is neces-

Corburetors While on the subject of deicing, it might be well to suggest that where gasoline engines are used a fluorocarbon insert in the throat of the carburetor might be a suggestion of considerable interest, due to the high probability of lessening the danger of ice formation at that point. Nat-Lubricants urally the lubricant will be made of fluorocarbons. This will greatly reduce the possibility of fire not only because of the removal of the hazard of the fire taking place at the bearing itself, but also from the coating of lubricant that occurs in the neighborhood of the bearings and which, when hydrocarbon lubricants are used, provides a highly combustible material every-

where within the vicinity of moving parts. Perhaps even the engine could be modified. If our point of view is the reduction of fire hazards, gasoline should be eliminated; a fuel having lower volatility and lower flash point should be used to reduce the probability of fire. Advantage might also be had in eliminating the high potential electrical circuits, which are necessary in the gasoline engine to provide the spark for ignition. With apologies to the courteous reader I should like to dream up an engine for the airplane to reduce these conditions of hazard. I realize full well that the details may not be forthcoming, and even with very considerable effort the final result may not be satisfactory or might not even be possible. But how can we be assured unless first we have a dream. Reciprocating engines have certain disadvantages as all engineers know. Turbines are advantageous in certain respects. The steam turbine is highly developed and is useful for many purposes. If it were possible to reduce both the weight of the engine and the weight of the fuel necessary for operating a vapor turbine, then this type of construction might be considered for the power plant of our airplane. Mentioned earlier was the fact that the compound (C,F,),O with a boiling point only I deg. C. higher than water had a molecular weight in the vapor of twenty-five times that of water. This material, therefore, at the same temperature and pressure of the vapor has a density about twenty-five times that of steam. For use in a vapor turbine this would greatly reduce the size of the necessary

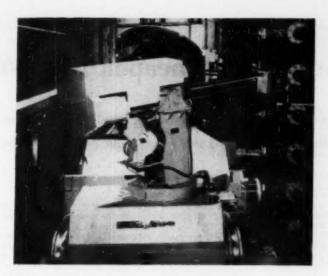
engine. It correspondingly reduces the size of

the necessary boiler. Of course with fluoro-

carbons we are not limited to a material with a boiling point the same as water. Any boiling point within certain limits that we desire can be provided by members of the fluorocarbon domain. It is well recognized that higher temperatures of the source of our heat engine provide higher thermodynamic efficiencies. Up to the point where the fluorocarbons would become corrosive for metallic parts, which is far above the boiling point of water, we could operate the fluorocarbon turbine. Higher boil- Fuels ing fluorocarbons also have higher vapor densities. This might enable us to use as a fuel an oil with a much lower flash point and volatility than gasoline. Such a heat engine requires, of course, no electrical spark for ignition, although such could or could not be provided depending upon circumstances. If such an engine were within the range of possibilities, and we should not casually dismiss it as impractical without serious consideration, then it might be possible to eliminate one of the most serious fire hazards of our airplane. The fluorocarbon used as the turbine impellent can even be employed to serve as a fire extinguisher should a fire begin.

If this dreamed-up airplane with greatly reduced fire hazards is offensive to the reader, please excuse. If some of the things are highly desired but considerable human effort is required for their accomplishment and funds are not provided for the very fundamental scientific work necessary, please don't lay the blame on the scientist and engineer. If the ideas themselves are considered as visionary, please realize that all desirable things are visionary until they become reality. It is hardly fair to condemn all visions, because some or even many have not vet been realized. We should rather appreciate that some visions have been the primary cause and motive for most of those things which we most highly value. There is just one question that I should like to put. Provided the above dreams could be accomplished, would you not "take a trip in my flying machine."

How long will it take to achieve many of the Whot's it useful results that appear eventually to come worth from the fluorocarbon domain? This depends to you? upon many human factors. In the first place, same results may be fairly easy to achieve; others will take considerably longer. The first materials should be commercially available within a year or two. New materials should be regularly added to our supply sources for hundreds of years. The particular time necessary for any one particular thing will depend upon the amount of effort that is spent on that thing. This amount of effort will depend in a large measure on either the money that is available for that particular thing or the whim of those either doing the work or supplying the funds. Many of the more important things can be obtained in a relatively short time-say five years-if we desire them sufficiently and are willing to spend sufficient effort. To the questioner that is interested in how long will it take before I can get such and such a material, the companion question must be put. What are you willing to provide, so that the material you desire can be available?



New Robot for Hanford

General Electric Co. has designed and built a five-ton "tool dolly" on wheels, which will be used in unsafe radioactive areas at the Hanford Works plutonium plant in eastern Washington. This one-armed "robot" can open and close doors, turn valves and take apart and reassemble complex machinery. It consists of a deck with a telescoping arm, on the end of which are double clamps. The arm can be extended, shortened, raised or lowered by remote control. The "hand" is capable of a wrist-bending motion, rotation and gripping.

The dolly also is equipped with a hydraulic ram, electrically controlled, with 4-ton pushing force, rotating devices for opening and closing valves and several specialized attachments. It rolls along narrow-gage railroad tracks under its own power. Six cables link it with the remote controls from an adjacent shielded room. A 3-ft. mirror, also remotely controlled, allows the operator to see what the device is doing.

Valve-turning attachments are equipped with electric "feelers" which indicate whether the valve handle is properly centered in the grasp of the turner. All in all, the dolly has 24 electric motors, 6 of them in the arm and hand.

Control panels equipped with lights indicate the position of the dolly's tools with respect to the apparatus being worked upon when it is impossible for the operator to watch the work through the mirror.

General Electric engineers say a man can be trained to operate the dolly in a week and that persons with no previous experience at manipulating the hand have been able, after a few tries, to pick up a dime.

What About Unit Operations Costs?

Editorial Staff

An important part of the duties of many chemical engineers and chemical engineers and chemical engineering executives is the estimation of processing costs and the cost of projected products. Yet this is a time consuming task requiring a lot of experience and it often produces discouraging results, either when the data are turned over to the company's cost accountants for further processing or, lacking that check, when it proves to be faulty in actual production.

We are indebted to Robert M. Boehm, director of research for the Masonite Corp., at Laurel, Miss., for the suggestion that it may be possible to develop a system for the preliminary estimation of unit operations costs which could do for operating cost estimation what our long series of equipment-cost articles has done since 1947 for equipment cost estimation.

In the equipment cost articles there was no suggestion that highly accu-

rate estimates could be prepared without accurate, detailed and up-to-theminute figures, but the methods put forth have made it possible in many cases to deal with preliminary estimates satisfactorily, and in a small fraction of the time normally required. Presumably, if some method of establishing standardized unit operations costs could be developed, it too would be limited in accuracy to use in pre-liminary estimation, but again it should be a great time saver in the earlier stages of process development when feasibility is being investigated, or the profit possibilities of several different processes are being compared.

As Mr. Bochm puts it, "Raw materials costs, utilities, yields and the like are basic costs of the operation and are largely, although not completely, independent of volume of production, changing labor costs, freight rates, and so on. But these basic costs are only a part, and often a minor part, of the mished cost of the product. Amortization, depreciation,

obsolescence, maintenance charges, operating labor, factory overhead, and other factors that cost men reserve to blight the dreams of research men, also have a terrific influence on the final result. Here is where long experience seems to count most, and where the most difficult part of the estimating job resides.

"My guess is that 80-90 percent of any manufacturing problem met in process industries can be broken down into the better known chemical engineering unit operations. With some simple method of calculating the costs of these unit operations, preparing the overall estimate would be greatly simplified, leaving perhaps only 10 percent of the problem for individual study."

So far, neither Mr. Boehm nor the editors know how such a study should proceed, nor in fact whether it is feasible. That is why we throw it open for discussion. We earnestly invite the correspondence of all readers who have suggestions, pro or con, on any phase of the subject.

A Cheaper Way to

Use specifications if you are going to order a small plant. You can assemble them easily using this plan. Your purchase will be

DONALD Q. KERN

More than half of the inquiries received by our process engineering division for medium size and small chemical plants are unaccompanied by specifications of any kind. An informal check with other contractors engaged in the design and construction of this class of chemical plant showed that the procedure is fairly prevalent on many projects running into several hundred thousand dollars.

In some cases where a chemical processor has no design engineering staff of his own the omission of specifications arises from the feeling that arbitrary specifications might increase the initial plant cost. And by sending his inquiries to several contract engineering firms it is believed that competition itself will establish the optimum design conditions. Actually, proposals which are prepared without specifications usually establish a plant of low initial cost. But this is by no means the most desirable characteristic in plant design nor does it favor the building of an efficient plant. The problem of providing specifications in sufficient detail to provide a plant reflecting the purchaser's wishes can be prepared in a short time with a minimum of technical personnel.

Specifications serve a very definite purpose. They are the means by which a processor can express his own preferences, experiences and expectations in detail. Moreover, well drawn specifications establish a comparative basis by which a processor can determine which contractor offers the most plant for the money. This is the truer index of value rather than the plant which can be assembled at the lowest cost. Buying at the lowest cost against good specifications is a prudent investment. Buying at the lowest cost without specifications frequently leads to a

succession of misunderstandings between the processor and the contractor.

Ordinarily a processor with raw materials of known quantities and composition wants to manufacture a definable product. Soon after submitting his inquiries he gets requests from contractors for more information on processing procedures, utilities data, pro-posed operating schedules, etc. Many of these questions cannot be answered without some study; there are usually too many questions coming from too many sides to permit organized study. There is usually plenty of chemical information from the processor's research chemists but little of it has design value to chemical engineers since engineering design experiments are not always included in the chemical research. As a result, when competing contractors ask about the processor's preferences he advises each to use his own preference. This leaves the door wide open for the design of a plant at the lowest price, for in time each contractor proceeds on the basis of his own competitive intuition. At that point the processor loses control of the situation.

Even among reputable contractors the bidding procedure often deteriorates into one in which all the contractors are guilty of some compromise with good engineering for the sake of a chean plant. Thus in a batch process plant without a prescribed operating schedule the equipment offered at the lowest cost may be small undersized vessels requiring numerous batch runs: these require so much labor that the operation does not prove to be nearly as profitable as anticipated. If the process is continuous, severe shimping becomes evident by a lack of overcanacity and holdun (important factors in enod design) as well as in other factors which facilitate smooth operation with little attendance. Indeed, by cutting down on such factors the cost of the attendant labor may rise so high as to invalidate the advantages of some continuous processes.

When all of the proposals are finally received by the processor each differs so widely from the other that a far more experienced staff is required to separate and evaluate them than would have been required to prepare good specifications initially. Each proposal reflects a more or less different interpretation of what the contractor desired or what he believed the processor wanted. And it actually requires far more skillful study to evaluate dissimilar proposals than it does to have a staff or an individual capable of writing brief specifications for a desirable plant.

A plan is offered here for assembling specifications in quick-time which can bring both organization and savings into the purchase of a chemical plant. These will not be air-tight specifications because such specifications require extreme skill and experience. A brief list is given in the accompanying check list. Its purpose is to ask the purchaser the questions which must be answered or assumed for the design of the plant. It may make a substantial difference in the final cost—depending upon who makes the assumptions.

One of the objectives of the specifications, even if complete details of the projected plant have not yet crystallized in the processor's mind, is to specify a definite plant on which all of the contractors will bid on the same basis. Then, if it is desired to make some alteration after receiving the proposals, the processor can feel fairly free to make changes at reasonable cost by working with the contractor offering to build the specified plant at the lowest price.

One of the unpleasant experiences in plant purchasing, however, is the so-called "extras." These are generally the costs of lesser items which the contractor has not enumerated in

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Buy a Plant-Know What You Need

organized and economical.

his proposal and for which he demands addit nal remuneration. They may add from 5 to 25 percent to the cost of the ple .t. Some contractors have been known to bid especially low by offering an incomplete plant and then to rely on extras to provide their margins. It is ironically true of such circumstances that items furnished during the progress of plant erection cost considerably more than if they had been specifically included in the in-

To the engineer who may have requested a certain allocation of funds it causes both embarrassment and a loss of prestige when he is obliged to approach his principals for more money to complete a supposedly well-planned job. The opportunities for extras decrease as the specifications are expanded.

WHAT DO YOU EXPECT TO MAKE?

This is the over-all statement of intention which defines only the overall li_its of the intention without defining the intermediate steps. It should be presented quantitatively and qualitatively since the sizing of all equipment depends on the throughput of the individual pieces of equipment. The sizes of many types of equipment are also influenced by the quality of either the initial r w material or the final product. Thus, the cross-section of a distilling column is related to throughput while height is dependent upon purity of product.

One of the most serious initial decisions lies in the realistic evaluation of the future production anticipated for the pl.nt. To keep the initial cost of the plant low there should be no tendency to minimize the future growth of demand for the product. The time to provide for expansion most cheaply is at the outset. This is particularly true of continuous and smaller batch processes. Serious consideration must also be

WHAT DO YOU EXPECT TO MAKE?

- (a) Capacity of plant-quantities daily, hourly or batch?
- (b) Quality of products—purities and properties?(c) Raw material—purities, properties, how stored, variations?
- (d) Future program-extra capacity is cheapest at the start.

WHOSE PROCESS? HOW OPERATED?

- (a) Is it standard and open to all contractors?
- (b) Is it restricted by patents and licenses to an individual?
- (c) Is the process your own?
- (d) Is it batch, semi-continuous or continuous?
- (e) Sequence preferences and tie-in with other plants? (f) Operating schedules-intermittency and part-time labor?
- (g) Guarantees-what do you expect for your money?

HOW MUCH PLANT DO YOU WANT?

- (a) Equipment?
- (b) Auxiliaries (piping, fittings, pumps, instruments and controls, etc.)?
- (c) Engineering?
- (d) Erection?
- (e) Buildings?
- (f) Revamp?

HOW DO YOU PLAN TO BUY 1T?

- (a) Firm price?
- (b) Cost plus-a-fixed-fee?
- (c) Cost plus-a-percentage?
- (d) Maximum price?

UTILITIES NEEDED? AVAILABLE? TO BE PROVIDED?

- (a) Electricity-voltage, phases, cycles, available quantity?
- (b) Process water-temperature, pressure, purity, quantity?
- (c) Cooling water-temperature, pressure, quantity?
- (d) Steam—pressures, superheat, available quantity, fluctuations? (e) High temperatures medium—Dowtherm or hot oil; vapor or liquid,
 - temperature, pressure, minimum return temperature, quantity?
- (f) Air-pressure, temperature, quantity?
- (g) Fuel-type, quantity, quality?

DESIGN CONDITIONS

- (a) Operating pressures?
- (b) Design pressures as a percentage above the operating pressures?
- (c) Operating temperatures
- (d) Codes, ASME U-68, U-69?
- (e) Design temperatures?
- (f) Instrumentation-automatic, semi-automatic, manual?
- (g) Underwriters labels?
- (h) Hazards?

MATERIALS OF CONSTRUCTION

- (a) As determined by the fluid or solid media, composition?
- (b) As determined by temperature?
- (c) Solid or clad, where applicable?
- (d) Percentage clad?
- (e) Alternates?

SPECIAL CONSIDERATIONS

- (a) Space available for plant.
- (b) Equipment preferences.
- (c) Other preferences.

given whether or not competitive products have been improving in purity through the years. Where purity has been improving ample overcapacity should be included in separation equipment so that it will be available when required to meet competition.

WHOSE PROCESS? HOW OPERATED?

Some processes are developed by contracting engineers and are covered by exclusive patents. Others are licensed by research or development groups either on an exclusive or a non-exclusive basis directly or indirectly to processors through contractors. Where processes are exclusively licensed, there is naturally only one contractor who can build for that specific process. There may be competitive processes, however, in which event comparisons must be made principally on guaranteed initial costs and operating costs respectively. If the process is the processor's own he must be sure that it does not infringe on any existing patents since it is not customary on the processor's process for the contractor to guarantee immunity from patent interference. If a process is assembled from among expired patents or the technological art of chemical engineering so that it appears to be outside the range of patent interference an economic preference should be established for a batch, semi-continuous or continuous process. These data should have been an integral part of the economic survey leading to the allocation of funds for the plant and should be conveyed to the contractor.

Part of the answer to the last question lies in the projected operating schedule the processor has in mind for the new process. Equipment which is to operate continuously for long periods will differ from continuous equipment which is to operate intermittently. For the latter special emphasis must be given to see that the equipment can be primed easily and that the priming operation or the going off stream does not produce a large quantity of an undesirable intermediate product even though this may increase the processing cost for the operation.

HOW MUCH PLANT DO YOU WANT?

The number of services bought from the contractor has a definite influence on the total cost of the project to the processor. The equipment usually constitutes the foundation of the purchase and such is assumed here in comparing additional services.

Does the processor intend to buy the auxiliaries from the contractor or does he intend to buy them himself? The auxiliaries include the piping, fittings, pumps, instruments, controls and the various other essentials which are not included as equipment proper.

Does the processor plan to do the engineering and procurement or will it be furnished by the contractor? The answer to this question is closely connected with the question of who will do the erection. Engineering involves the design of all the supporting members and execution of the details for interconnecting auxiliaries and devices within an allocated building or outdoor area. If the processor buys the equipment without engineering, with the intention that he will install it and erect it himself, there may be some savings on the engineering and drawings which are usually prepared by contract engineering firms. However, the total cost of engineering is relatively so small it is unwise to forego the advantages of a staff experienced in layout. A contractor's staff gives consideration to myriad details some of which may be overlooked by operating engineers, for example, the accessible location of the equipment, the location of controls and instruments in positions for simple operation, etc. Installation of a well engineered plant reduces to a minimum the amount of building to be broken up and the equipment itself is designed to facilitate support within the framework of the existing or projected building. Ordinarily, the auxiliaries cost very little, if any, more when purchased from a contractor who enjoys certain bona fide resale privileges than from the original vendor and procurement and selection are the responsibility of the contractor.

Where a new building is also a part of the projected plant the project is best initiated by conferences between the prospective contractors and the processor after which one or two of the common types of plant construction will appear most favorable.

Another point worthy of consideration is the possibility of revamping some existing equipment into the new planj. If the amount of equipment to be revamped represents perhaps 25 percent or less than the cost of the new equipment the matter of revamping can be deferred until the most probable contractor has been selected. He will then quote allowances, including fabrication, engineering or erection as desired for each item of equipment.

HOW DO YOU PLAN TO BUY IT?

The way in which a plant is bought influences the contractor's costs and contingencies, all of which are passed on to the purchaser. Equipment alone for a plant is sold on a firm price. Depending upon the size and nature of the plant, most processors prefer to buy both equipment and some services on the basis of a firm price. Notwithstanding the receipt of a firmprice quotation, there is still the possibility that loose ends and changes which develop while the plant is being executed may incur some extras. If several quotations are received, they may be cross checked by tabulation to see if one or the other contractor has left any glaring omission which might show up later on as a sizable extra. The majority of plants in the quarter-million dollar class are bought with equipment, engineering and supervision of erection by the contractor and erection labor supplied by the purchaser. This enables the purchaser to supply part of the erection labor from his own maintenance personnel thereby adding to their familiarity with the new plant.

A form of purchase which has been popular on larger projects is the cost plus-a-fixed-fee contract. Here, because the cost of the equipment is usually not an indication of the amount of design, engineering and procurement which must be performed by the contractor, a prospective purchaser feels he has a right to know how much gross money the contractor is going to receive for services on the contract. Ordinarily, the fixed fee will run anywhere from 5 to 10 percent of the cost of the equipment plus other services and will not include contractor's out-of-pocket expenses nor the direct engineering costs. which are paid for on an hourly basis or at the contractor's actual costs plus a percentage for overhead.

A type of contract which was popular during the recent war was the costplus-a-percentage contract. In normal times this has always been considered objectionable. The cost plus-a-fixed-fee contract gives the contractor every incentive to get the job done as cheaply and as quickly as possible. In a competitive market the cost-plus-a-percentage contract secures no advantage for the purchaser.

Still another type of contract is the maximum-price contract. In a firm-price contract the contractor includes an allowance for contingencies which is from 5 to 20 percent of the firm price. The maximum-price contract is similar to a firm-price contract except that the contractor offers to remit

all or a percentage of any savings he might obtain from the estimated maximum price during the course of the job. There is some merit to a maximum-price contract inasmuch as it is sometimes necessary to estimate entire plants in a hurry and the contractor is entirely willing to give back any excess amount.

UTILITIES

There are three important questions which must be answered on the matter of the utilities. These are: (1) Which are needed? (2) Which ones are available? (3) Which new ones must be provided? The need for new utilities can often influence the desirability of building a particular plant. The principal utilities are electricity, process water, cooling water, steam, air and fuel. The questions detailed in the check list should be answered rather comprehensively since they influence the design and size of equipment.

DESIGN CONDITIONS

While operating conditions are fixed by the process the design conditions such as pressure and temperature should be considered closely with re-lation to the code to be employed in fabricating the equipment. The combination of conditions, material and code can affect the total cost of the plant to a very great extent. In the absence of definitive specifications differences in design conditions, material and code can also account for large discrepancies between competing contractors. In many states and municipalities there are mandatory codes covering the elements of construction to be employed in fabricating vessels operating at pressures usually at 15 psig. and greater. Therefore, there is considerable advantage to the avoidance of design pressures above 15 psi. unless absolutely necessary. The use of simplified or generalized conditions such that all vessels have a minimum design pressure whether necessary to the process or not should be avoided. Ordinarily, when the operating pressure exceeds 15 psi. the design pressure is fixed at from 10 to 25 percent above the operating pressure.

Specification of excessive design temperatures is costly, particularly for non-ferrous materials whose working stress decreases with temperature in the low temperature range and for certain classes of ferrous castings. For the case of steel in fabricated and plate form there is no structural problem in specifying a design temperature of

650 deg. F. so long as adequate expansion facilities can be provided cheaply. For cast iron 200 deg. F. is about the upper limit. For the nonferrous alloys the allowable working stress starts to decline rapidly above 200 deg. F. and the use of high pressures and high temperatures with nonferrous alloys or ferrous castings should be avoided. Design temperatures are usually chosen only as much above the operating temperatures as are reasonable for the fluctuations which can result from the range or failure of controls or to incorporate a realistic safeguard against expansion and contrac-

In many cases equipment design follows the paragraphs of the ASME Code or the principal features of it which are embodied in territorial and local codes. The principal paragraphs of the code are U-68 which is an unlimited code and U-69 which is restricted but which permits a cheaper type of construction. The use of ASME U-68 should only be specified when confining a toxic fluid at a pressure or temperature beyond the limits of ASME U-69.

Use of automatic instruments is also an important cost factor since in certain processes the instruments might run as high as 25 percent or more of the total value of the equipment. For this reason, the operating schedule should be considered as well as the number of operators available to monitor the plant and those who must be assigned specifically to operate it. For the most part, there is a wide range in the amount of automaticity which may be incorporated into the design of a plant. Some instruments and controls are fairly expensive and where many instruments are to be used, it is advisable that they be air operated so as to reduce the cost of relays and motors. On electric equipment the designation of explosion-proof housings or Underwriters labels increases initial costs but permits a reduction in the insurance rate of the plant which usually permits writing off the additional cost in short time. Where special hazards are involved much can be accomplished by a discussion with commercial insurance representatives.

MATERIALS OF CONSTRUCTION

This is frequently the critical cost factor because there is such a broad discrepancy between the costs of the various alloys and non-ferrous metals compared with common materials. For example, tubing of Type 316 stainless steel may cost six times as much as equivalent tubing of carbon

steel. Similar divergencies arise in the use of the non-ferrous metals. Some fluids which attack metals are passive to wood. One of the costliest decisions is incurred by the simplified specification of a single alloy or non-ferrous metal for an entire process merely because at one stage or another in the entire process a fluid is apt to cause the corrosion of baser materials. Many fluids are not corrosive at low temperatures although they are corrosive at high temperatures and some solutions which are corrosive when dilute are not corrosive when concentrated. Such questions can usually be answered by consulting standard corrosion data or running a few inexpensive

The presence of a corrosive fluid does not necessarily call for the use of a solid alloy for protection. There are a wide variety of alloy clads and nonferrous liners which can reduce the cost of the plant considerably. However, if at moderate pressures more than a 15 or 20 percent clad is desired it will usually pay to go to solid alloy. Still other savings can be made by using several alloys if there is a difference in the relative cost of fabricating each, such as stainless steel fabricated vessels and cast aluminum equipment.

SPECIAL CONSIDERATIONS

Very often it is the purchaser who is more familiar with the circumstances that must be incorporated in a prospective plant than the contractor. Since one of the functions of the specifications is to give the processor an opportunity to air his preferences, he should not hesitate to make them known along with any unusual conditions relating to the processes. For example, it may have been found that elevating a temperature above a certain level causes discoloration or that operation at one pressure or another has a marked effect upon foaming. Any of these innumerable technological factors should all be contained in the specifications.

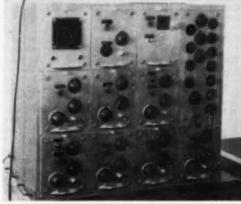
By running through the check list on p. 139 it is not necessary to answer all of the questions. But each question which is answered reduces the chance for misunderstanding to some extent and at the same time defines the objectives better and better. They keep the purchaser in control of the situation. Even the most cursory treatment of the check list can contribute some economy to the purchase of the most desirable plant which is, after all, the cheaper way to buy a plant.

How Analogical Computing Devices

Can Serve

Process Industries

Analog computers, designed to solve specific problems in process industries, are giving solutions where only trial and error formerly sufficed, where speed is essential, where some factors are unknown.



Electronic analog computer developed by Phillips automatically aclves flash vaporization equilibrium equation for hydrocarbons, climinating laborious trial and error computations.

W. L. MORRIS and F. W. BUBB

In the past ten years several universal, widely applicable computers, such as the ENIAC, the IBM-Harvard Computer, and others, have been constructed and put into operation. Because these machines can cope with almost any mathematical problem, and are spectacular in size, they have attracted much attention and have tended to obscure the concurrent development of numerous smaller computers designed to work day by day in the solution of special analytical problems which recur frequently in process and other industries.

In operating certain industrial processes, it is necessary to solve the same problem repeatedly. For such specialized use, a universal computer is neither needed nor appropriate. Instead, one needs a special computer for the problem in hand. Such special computers should be reliable in operation, capable of continuous operation over extended periods, of minimum size and cost. It has been found that a certain type of computer known as the analogical type is peculiarly adapted to these requirements.

In contrast to the universal or digital type of computer which deals only

with numbers, the analogical type of computer is a physical system concerned with physical quantities. The industrial process to which the analogical computer is matched is ordinarily described by mathematical equations. The analogical computer is made so as to be governed by the same equations, and so that each quantity in the prototype process has its analog in a specific quantity of the computer. For example, a temperature in the prototype process may be represented in the computer by a shaft rotation, or a voltage, or by some other quantity. It is the analogical type of computer that we are concerned with here.

WHAT COMPUTERS CAN DO

Analogical computers are used effectively in three types of problem: (1) Those in which analytic methods entail lengthy trial and error procedures; (2) Those in which boundary, or initial conditions, or both, are complex; and (3) Those in which speed in solution is essential to the success of the operation.

A problem often met, for which analog computers are adapted, is the type where no convenient analytic method exists for the direct computation of an answer. An example is the solution of phase equilibria in the flash vaporization of mixtures of hydrocarbons. Here the determination of V, the fraction of the composite hydrocarbons which is in the vapor

state, involves the rather laborious trial and error solution of

$$\sum_{i=1}^{n} \frac{Z_i}{1 + V(K_i - 1)} = 1$$

where Z_i is the mol fraction of the ith compound of the mixture; K_i is the equilibrium constant of the ith compound; and n is the number of compounds in the mixture.

The human computer does this problem by guessing a value of V, inserting this into the equation and computing its left side, which is generally found not equal to 1. Another value of V is then chosen, the left side calculated again, and so on until a value of V is found which makes the left side satisfactorily close to 1.

The Phillips Electronic Analog Computer was developed to solve this problem (Bubb, F. W., Nisle, R. G., and Carpenter, P. G., J. Pet. Tech., 2, 143-48, May 1930). The computer is an electro-mechanical system comprising a number of units, one for each component in the mixture. By the proper setting of potentiometers, the K and Z pertaining to each component are set on dials. The value of V which is common to all units is set simultaneously in all units by a single dial. A voltage of the form $EZ_t/[1 + V(K_t - 1)]$ is generated by each unit and these are added and compared with E_{∞} the line voltage, by a galvanometer. If the galvanometer

W. L. Morris is with the Phillips Petroleum Co. at Bartlesville, Okla., while F. W. Bursh is with Washington University, at St. Louis, Mo. This paper is a Research Department Report, No. 802-50R, from Phillips.

does not balance, V is varied by turning its single dial control until balance is indicated, that is, until V is such that the above equation is attained, V is read from the dial. Provision is also made so that once the equation has been solved for V, the mol fraction of each phase (vapor and liquid) of each compound may be read directly from the computer.

The analogy with the human process consists in the correspondence of the cut and try choice of V with the adjustment of the dial. The pencil calculations of the human computer are performed automatically and almost instantaneously by the computer.

The second type of problem is that in which the boundary conditions are irregular. Into this class fall all potential theory problems in which the boundary itself is anything other than a circle, infinite half plane or certain other idealized forms. Two specific examples of problems of this class are: the flow of heat in irregularly shaped bodies with non-simple boundary conditions, and the flow of fluids in petroleum reservoirs.

Analogical computers have been constructed to solve these problems and the two computers are fundamentally the same. The conducting medium, whether heat-conducting in the first case or fluid-conducting in the second, is represented by an electrical network of resistors and capacitors. The resistance to flow of electrical current in the network is the direct analog of the resistance to flow in the medium and the capacity of the network is the analog of the capacitance of the medium to store heat or fluid. The analog of flow, either heat

or fluid, is electric current, and the analog of temperature or fluid pressure is electric voltage.

By proper design, these computers can be so constructed as to be capable of application to a wide variety of problems in each field. Thus, heat flow in one medium of irregular outline and conductivity may be computed in one problem and the computer may then be converted readily to study heat flow in a medium of completely different type and shape.

Similarly the computer designed to study the flow of homogeneous fluids in a permeable medium (e.g., a petroleum reservoir) is so constructed as to be applicable to almost any size or shape reservoir.

A third type of problem where analogical computers find a peculiar utility is that in which speed of solution is essential. The solution of systems of linear simultaneous equations is an example of this type. Such systems of equations arise in many places in process industry as, for example, in the infrared analysis of hydrocarbon streams. Here the absorption by the stream of different frequencies of the infrared radiation vields linear algebraic equations, one equation for each frequency band of radiation used. The variables are the mol fractions of each hydrocarbon compound in the stream, and the

Solution of a system of this kind, although straight-forward enough, is tedious and lengthy when the number of hydrocarbons in the stream is four or more. Since this type of analysis is made for process control purposes, speed of solution is necessary

constant coefficients the absorption co-

efficients.

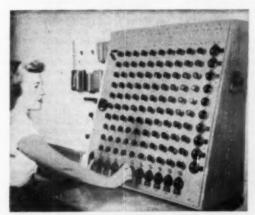
in order that the operator may receive information quickly enough to enable him to maintain the stream at the desired composition.

Several computers have been made to perform this calculation. The computer in its usual form consists of a network of electrical resistors arranged in rows and columns. The coefficients are set into the machine by setting variable resistors to the pertinent values. The total extinction usually written on the right side of a linear equation is set into the machine by feeding a voltage of proper magnitude into the proper row. In one design the answers appear directly as voltages at the bottom of the columns. Incidentally, this last type of computer lends itself very well to the actuation of automatic controls for regulating the proper composition of the stream.

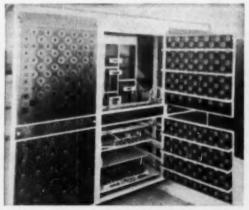
SIMULATORS

More and more often we are encountering processes, phenomena or mechanisms of such great complexity that we find ourselves in the position of knowing the end results of the process, of being able to derive but not to solve the differential equations governing the phenomena, and of being able to measure at most a part of the pertinent parameters of the system. In many such systems, magnitudes are such that a statistical or direct experimental approach is entirely impossible. Then the only known systematic approach is by construction of a "simulator".

The simulator may be a device which is indistinguishable physically from a computer. In fact, as we shall see, we normally expect to use it for



Typical of analog computers designed to speed up operations is the Phillips Spectro Computer which solves linear simultaneous equations such as those met in infrared and mass spectrometry.



Another class of device, the simulator, permits "synthetic" experiments. Here is the interior of the Phillips Reservoir Behavior Analyzer, a variation of the Carter Oil Pool Analyzer.

the computations in the next stage.

The simulator is built so as to be governed by the same differential equations as govern the prototype, and so that all variables and parameters of

the prototype have their analogs in the variables and parameters of the

In operation, those parameters of the prototype which are measurable are set into the simulator and reasonable values assumed for the others. The simulator is then set in operation and allowed to proceed to the end result. This is compared with the end result of the prototype. If the two are the same, it is assumed that the simulator is a true analog of the prototype. If the two end results differ, successive adjustments of the simulator parameters are made until the two end results are the same.

Thus, we use the simulator as a substitute experimental system. Experiments may be performed on the simulator so as to give systematic direction to observations of and opera-

tions on the prototype.

Once the simulation experiments are completed, the device can be used as a computer for the solution of other problems and the study of other performances of the prototype.

An example of a simulator is furnished by application of the heat flow computer to the inverse problem of designing, say, a heat exchanger to have certain properties. In this problem, certain of the parameters such as specific conductivities and, perhaps, over-all dimensions would be known, but others such as geometrical arrangement would be the solution desired and hence unknown initially. In such a case the heat flow simulator is set up with the known parameters and with some reasonable assumed geometry. It is then placed in operation and its result compared with the desired result. If the two differ, the parameters, such as geometry of the simulator, would be adjusted until the two results are the same. The desired design is then read off the simulator, and the simulator itself is then used to predict or to compute the behavior of such a design under varying conditions.

Another example of a simulator is found in the Reservoir Behavior Analyzer. In the case of a petroleum reservoir we frequently have a fair idea about the essential parameters of the reservoir itself, its shape, size, permeability, porosity and so on, but have very little knowledge of the surrounding aquifer which is the source of the water drive.

To obtain this information, we make use of the analyzer as a simu-

lator. We set the known parameters into the analyzer and make reasonable assumptions regarding the unknown parameters and set these in the analyzer, also. We then operate the simulator reservoir according to the production history of the prototype reservoir, and compare the pressure history of the analyzer with that of the prototype. By varying the aquifier parameters until the two pressure histories coincide we obtain what is accepted as a true analogy between prototype and analyzer. The analyzer is then used as a computer to predict future behavior of the reservoir.

AUTOMATIC CONTROL

Modern development of automatic control has been made possible only by the concomitant development of computers. In their application to, and incorporation in, automatic control systems, computers find their greatest utility. In the large sense, by organizing the several parts into a harmoniously integrated system, one achieves a final result in much the same way as an artist works out details of different portions of a picture and then completes a masterpiece by combining them all into a coherent unity.

Simple automatic control devices, such as liquid level controls, have been in use for centuries. Other devices, such as thermostats, steam pressure regulators, speed governors and the like have been used for decades. Devices of this kind are generally actuated by the quantity which they are to control. For example, a gas oven thermostat will compare the oven temperature with a standard (desired) temperature and if the ambient temperature is less than the standard, the thermostat will cause the gas flow to increase. If the ambient temperature is higher than the standard, the thermostat will shut off the gas and permit the furnace to cool down. In this case, modern terminology would call the temperature the measured variable and the flow rate of gas the controlled variable.

In the control of a process, however, no such simple relation ordinarily exists between the measured variables and the control variables. For example, engineers will operate a chemical process plant by making measurements such as pressure, temperature, composition, etc., at various points in the plant. These measurements are fed into formulas, such as material balance equations, mass action relations, etc., which yield answers such as valve settings, pressures and temperatures to be used, and so on. These answers are now the control variables and as such are commands to ampli-

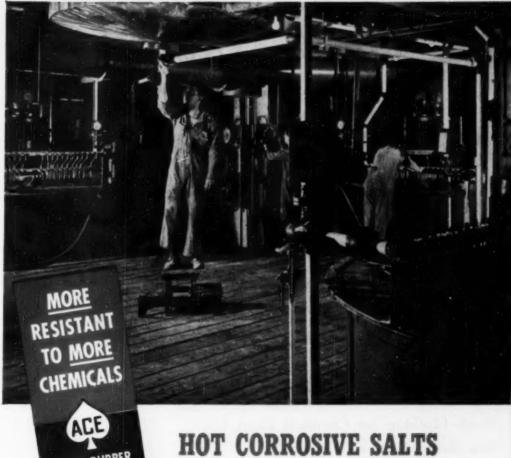
fiers and servos which adjust the process. In the absence of automatic controls, computations have had to be made by analytic means and the results therefrom put into effect manually.

It is now possible to accomplish this control process by construction and installation of integrated sensing-computer-control systems which (1) observe the measurable variables, (2) feed these results to computers which determine the proper values of the control variables, and (3) transmit that information to the control mechanism which finally operates the plant in response to that information.

It should be emphasized that although this picture represents an ideal, it is by no means an unattainable ideal. Many plants whose processes are thoroughly understood are, in fact, installing systems of this kind. Other plants whose processes are still in development may not make immediate use of full automatic control systems but can still make use of less comprehensive systems which, after the process development has been completed, can be integrated in the complete system.

An example is furnished by the simultaneous equation solver already mentioned. The mol fractions of the various components in a liquid or gaseous mixture appear in the com-puter solution as voltages. Each of these voltages can be compared with a standard voltage which will be proportional to the desired mol fraction of that compound in the stream. If one computer voltage is higher than the standard, indicating thereby too great a concentration of that compound in the stream, a motor is actuated so as to turn a valve reducing the amount of that compound entering the stream. Conversely, if the concentration of that compound is too low, the valve will be actuated to increase its flow.

To sum up, analogical computers do not need to be large instruments, of universal application and expensive, to be important to industry. Rather, they can be specialized to solve the particular problems of that industry, to do so reliably, and at a considerable saving of time and money. Furthermore, in many industrial applications, analogical computers serve by taking on the alternate role of simulators in which they act as substitute experiments where the prototype experiment is either too expensive to perform repeatedly or even impossible to perform at all. Finally, analogical computers find wide application as an integral part of modern automatic control systems.



HOT CORROSIVE SALTS almost too hot to handle

POUR TIMES A DAY, metallic salts in hydrochloric and hydrofluoric acid solutions are heated to a near boil and cooled to room temperature, in these digesters and crystallizing tanks. The hot acids are extremely corrosive, and the constant change of temperature is rough on the tanks. Most materials would not stand up or would be too expensive.

Best answer was found in ACE hard rubber linings—the two-layer protection that is both chemically strong, and mechanically tough. Approximately 40 ACE rubber-lined tanks are now in service in this plant. Many have been on the job for eight years.

The fume ducts in the background, incidentally, handle hydrofluoric acid vapors. They, too, are ACE protected.

ACE hard rubber resists all alkalies, metallic salts, inorganic acids, hydrochloric acid any strength, nitric acid to 16° Be, sulphuric acid to 50° Be, phosphoric acid to 75%, and countless other corrosives. Other ACE plastics extend this range still further. Ask for catalogs of ACE-Clad and ACE-molded chemical equipment.



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HARD RUBBER
COMPANY
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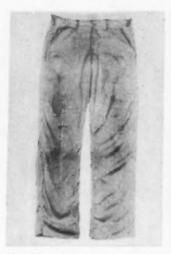


Process Equipment News

THEODORE R. OLIVE, Sonior Associate Editor



These cotton trousers were used one week in heavy metal chloride service and disintegrated after one washing.



Chem-Wear trousers were used three months in same service, with weekly washings, and are still in use.



Chem-Wear clothing is claimed by its manufacturers to resist 95 percent of the corrosive chemicals used in industry.

Work Clothing for Chemical Plant Use Now Being Made of Vinyon N

Known as Chem-Wear the new clothing is said to resist 95 percent of corrosive chemicals used in industry.

Savings as high as \$100 per year per min are claimed as a result of using the new Chem-Wear industrial clothing which is made of Union Carbide's Vinyon N yarn, instead of conventional work clothing. Manufactured by the Chem-Wear Corp., Vinyon N garments are said to have outlasted cotton and wool trousers as much as ten to one in acid plant use. In laundering tests the clothing has withstood over 65 hr. of continuous commercial laundering in the highest caustic soap concentrations used in laundries-roughly the equivalent of 120 average washings, which is many more than conventional work clothes can withstand. Greases and waxes can safely be removed by solvents and caustics that would destroy ordinary clothing.

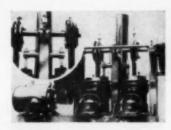
A recent series of tests on the fabric, conducted by an independent laboratory, showed no shrinkage and no appreciable change in pliability and hand even after 20 hr. immersion in such reagents as concentrated hydrofiuoric acid, 30 percent nitric acid at 80 deg. C., 85 percent phosphoric acid at 100 deg. C., 70 percent sulphuric acid at 50 deg. C., and 50 percent sodium hydroxide at 100 deg. C.

The new clothing is not intended for protective wear since it is not coated and may allow splashes to seep through. Although it is not fireproof, it is fire resistant and will not support combustion. Its chief advantage, therefore, is to last much longer than work clothing of conventional fibers and so save the cost of frequent replacement. All conventional sizes of coveralts,

laboratory coats, matched shirts and trousers, jackets and bib overalls are now available.

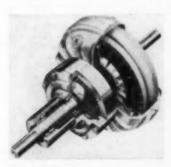
VALVE AND FLANGE COVERS

An associated concern, Milsheff, is also using Vinyon N fabric, but with a heavy coating of a vinyl compound to make it liquid-proof, in the making of valve and flange covers. These are tied on to the valve or flange as a safety feature to prevent possibility of spurts of corrosive chemicals. They are claimed to be handier than present covers and are many times lighter and cheaper than lead. Flange covers come in a complete range of sizes for 1- to 6-in, pipe, with larger sizes avail-able on order. They are made in two types, for back welded or welded flanges, and for threaded types. Because of the many types of valve in each size, valve covers are made only to order, in which case the manufacturer will fill orders for a minimum of 50 covers for any valve type and size, made to fit the individual valve exactly.-(For clothing) Chem-Wear Corp., 740 Broadway, New York, N. Y.: (for valve and flange covers) Milsheff, 740 Broadway, New York, N. Y.



Sludge Pump Guide

A new crosshead guide (147A) assembly which can be furnished when specified on all plunger sludge pumps of its manufacture has been developed by the Ralph B. Carter Co. The guide is applicable to single, double and triple plunger pumps. It consists of a steel crosshead guide rod, rigidly secured to each plunger. The guide rod travels through bronze guide bearings in a vertical plane with the plunger. These bearings are securely mounted on the vertical stanchion of the pump base so that the guide is perpendicular to the eccentric motion of the connecting rod. This arrangement eliminates misalignment of the plunger and reduces possibility of excessive wear on the packing gland, plunger and cylinder. Constant lubrication of the guide is provided by a sight feed oiler.-The Ralph B. Carter Co., 210 Atlantic St., Hackensack, N. J.



FOR AGITATORS, WINDERS: Hydraulie Drive

Combining a planetary gear set and an hydraulic coupling in one unit, Twin Disc Clutch Co. has developed the Hydro-Wynd Drive which is said to be particularly suitable for the constant-tension winding operations and for agitator drives where material consistency is to be controlled. The ring gear of the planetary gear set is secured to the impeller on the hydraulic coupling, while the planet gear carrier is fixed to the runner of the

coupling. The sun gear connects to the output shaft. In operation, the automatic slip of the coupling reacts with the gear set against the varying torque and speed requirements of the driven machine, enabling the new coupling to replace adjustable slip clutches or other devices formerly used. As the torque load changes, the Hydro-Wynd correspondingly changes output torque-rather than horsepower-directly in proportion to the load imposed. This permits smooth, fast starts as predetermined lineal speeds and tensions, without adjustments. However, wherever the tension or lineal speed must be varied, the new drive can be used in conjunction with a conventional variable speed drive.-Twin Disc Clutch Co., Racine, Wis.



OIL-SEALED: High Vacuum Pump

Adding to its line of high vacuum pumps, Kinney Mfg. Co. has developed a new small compound vacuum pump known as Model CVD 3534. This pump has a free air displacement of 4.9 cfm. and operates on a 1-hp. motor. The pump employs the same oil-sealing system used on the company's larger pumps and on a blank test is said to produce McLeod gage absolute pressure readings of 0.1 micron, or better. The pump is compact, ruggedly built and quiet in operation. The double sealing-oil reservoirs are said to provide continuous oil purification, thus promoting consistent production of high vacuum, regardless of surrounding atmospheric conditions.-Kinney Mfg. Co., 3551 Washington St., Boston, Mass.

DETECTS LEAKS:

Halogen Meter

A new meter for toxic range analysis of halogen derivatives of hydrocarbons has been announced by Davis Emergency Equipment Co. The new instrument is based on a design originally perfected by Du Pont. It (Continued)

More Information . .

To learn more about any item described here, circle the item's number on the Reader Service Postcard inside the front cover.

This Month . . .

Now that July, the month of the Tom Collins, is here, it occurs to us we may be missing a bet in not making this a special hot weather section, devoting ourselves exclusively to cooling ideas. But we've combed the files-not a single automatic bartender, nary a personal air conditioning set that plugs into the nearest ether wave, not even a salt tablet dispenser! So, back to our original love, and the equipment therefor. Even so, there are some mighty fancy ideas disclosed in the later pages. For instance, polyethylene flame sprayed coatings to solve your tank corrosion problems, on page 148; and a new line of miniature recorders on page 150 which will add the recording function to that new graphic control panel. For something really novel in steam heating, take a look at the steam circulator on page 154. And if you have fine grinding or dust problems, the new fine material classifier on page 154 will click.

Next Month . . .

As a measure of the shape of things to come, look for a new long-life coating system combining sprayed metal and an organic film; a conductive paint for surface heating by electricity; and a clutch pulley which changes ratio automatically.

Marshall and Stevens Indexes of Comparative Equipment Costs

(1926 = 100)

(1926 = 100)

Compiled quarterly for March, June, September and December of each year by Marshall and Stevens, Actuation conference, Chicago and Actuation conference, Chicago and Compiled Compiled and Compiled Compiled

Industry	June 1949	Mar. 1950	June 1250
Average of all	160.6	160.0	162.1
Process Industries			
Cement mfg. Chemical Clay products Glass mfr. Paint mfr. Paper mfr. Petroisum Ind. Rubber Ind. Process ind. svg.	155.9 163.9 150.9 154.0 157.2 157.5 160.3 167.7 161.4	151.5 150.5 153.6 156.8 157.1 159.9 162.2 160.9	159.1 155.1 156.2 159.7 162.5 164.9 163.5
Related Industries			
Elec. power equip Mining, milling Refrigerating Steam power	165.5 165.6 174.8 152.6	165,1 164,2 174,8 152,2	167.7 166.8 179.4 154.8

NEW EQUIPMENT, COUL. . .

employs a photoelectric photometer to indicate changes in the intensity of the blue spectrum of a copper are discharge in the presence of organic halide vapors. Meter readings are said to be accurate within 10 percent, sensitivity increasing approximately as the number of halogen atoms per molecule. The instrument weighs 35 lb., and operates on 110-volt, 60-cycle current. It is said to be particularly suitable for detecting leaks of chloride refrigerants and the chlorinated solvents.—Davis Emergency Equipment Co., 45 Halleck St., Newark, N. J.



FOLLOWS ANY CURVE:

Flexible Conveyor

(148A) A new design of portable, flexible, gravity-roller conveyor, produced under the name of Flex-co by Berlin Chapman Co., is produced in width of 12, 18, 24, and 36 in. It can be installed in any combination of radii, for example, two 45-deg. turns, or a 90-deg, turn that has seven units in it, or a 180-deg, turn which is 10 ft. 6 in. long. Thus, the conveyor can be adapted to follow any desired pattern without regard to building design. It is also flexible in elevation, having telescoping legs which allow the height of the rollers to be set to any desired point above the floor. Berlin Chapman Co., Berlin, Wis.



Immersion Thermostat

(148B) Known as the Rocket, a new pencil-type immersion thermostat has been introduced by Ulanet. The

thermostat is rated at 1,500 watts at 115-230 volts a.c. non-inductive load and it can be supplied in various adjustment ranges to operate at temperatures from +100 to +700 deg. F. The instrument has a plastic adjustment knob with numerical gradua-tions. Its rapid-responding thermal element comprises a metal tube and rod of different coefficients of expansion, securely bonded to each other at one end. The opposite end of the rod operates a switch mounted on a sturdy casting. No pivots or linkages are required. Over-ranging is said not to affect the calibration. Depending on requirements, thermo-responsive elements varying in length from 41 to 18 in., in various alloys to suit speeific requirements, can be provided .-The George Ulanet Co., 417 Market St., Newark 5, N. J.



PROTECTS METALS:

Flame-Sprayed Coating

(148C) Under the name of Nukemizing, a new flame-sprayed membrane coating has been developed by Nukem Products Corp. The new coating is said to give resistance to nearly all acids, alkalies, salt solutions and some solvents. By flame-spraying a mixture of polethylene resins, to which modifiers have been added to improve adhesion, hardness and thermal properties, an impervious resin film is formed over steel surfaces. Such coating is carried out only by the manufacturer, using special equipment developed for the purpose.

The new coating is said to be low in cost relative to other similar coatings and linings, completely without pinholes or voids, and easy to patch if necessary as a result of mechanical injury. It is said to withstand liquid temperatures up to 140 deg. F.—or higher in some cases—and fume exposure temperatures up to 220 deg. F. Installation is done on the job and imperviousness demonstrated after completion, using an electronic tester. Installation requires no flammable

solvents, hence causes no fire hazard or objectionable fumes or odors.— Nukem Products Corp., Buffalo 20, N. Y.

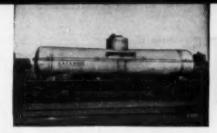


WIDE SELECTION: Teflon Shapes

In addition to the gas-(148D) kets normally suppled, U. S. Gasket Co. is now able to supply from stock a wide variety of sheets, rods, tubes, bars and cylinders of DuPont Teflon. In addition, on slightly longer delivery, the company can provide Teflon molded specialties. Sheet is available in thicknesses from 0.063 in. up, in standard size 24x24 in., or special sizes to 36x36 in. Blocks come in thicknesses from ½ to 2 in. and in any shape upon request. Tubing is available with inside diameters from ½ to 11 in. and outside diameters from 1 to 2 in. Continuous rod and tubing in. O.D., with standard lengths up to 2 ft. and special lengths up to 10 ft. in larger sizes. Cylinders come from 1 in. I.D. to 40 in. O.D., with a minimum wall thickness of 1 in .-Teflon Products Division, United States Gasket Co., P. O. Box 93, Camden, N. J.

HOLDS PRESSURE: Hydraulic Test Pump

Milton Roy has developed a new pump, specifically designed for the testing of pressure vessels and vacuum equipment, at pressures up to 25,000 psi. The liquid end of the pump, which provides the hydraulic test pressure, has double ballcheck valves said to be self-cleaning and non-clogging. The power end is an air cylinder of suitable diameter to give the desired hydraulic pressure from the available air pressure. For example, a 12-in. air cylinder driving a 1-in. hydraulic plunger and operating on 80 psi. air will develop 25,000 psi. hydraulic pressure. The pump operates at full stroke length and maximum strokes per minute until the prede-(Continued)



The first aluminum tank car ever built was produced by General American in 1928. It was GATX 8000-built specifically for Glacial Acetic Acid.

GATX aluminum cars for chemicals

nodern GATX aluminum cars

now carry:

Glacial Acetic Acid · Formaldehyde Hydrogen Peroxide Bleach · Fatty Acids Acetic Anhydride · Naphthenic Acid Butylaldehyde · Water White Rosin Glycerin · Nylon Salt Solution 52% Hydrogen Peroxide · Nitrogen Fertilizer Oleic Acid · Nitric Acid

Trichlorobenzene · Ammonium Nitrate

Bulk shipping keeps pace with chemical progress

why aluminum c

Before GATX 8000

PURDER



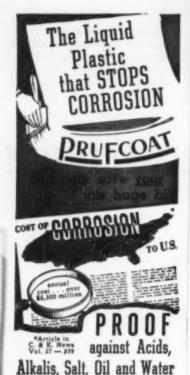
GENERAL AMERICAN TRANSPORTATION CORPORATION

135 South La Salle Street

Chicago 90, Illinois

District Circle Buffalo . Cleveland . Dallas . Houston . Los Angeles New Orleans . New York . Pittsburgh . St. Louis . San Francisco Seattle . Tulsa . Washington

112011 012 10 East 49th Street, New York 17, New York



"Prulocat proves superior to all other coatings we have tested"... writes one of America's largest chemical companies, after eight years' experience with Prulocat. And this is just one of many reports on file testifying to the effectiveness of Prulocat's lamous liquid plastic formulations in controlling corrosion caused by chemical agents such as these:

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Send today for a Prulcoat PROOF Packet. Contains in one easy-to-file folio outside laboratory tests, case histories, and Prulcoat Protecto-Graph Plan for analysing your own painting maintenance costs. Write Prulcoat Laboratories, Inc., 83 Nain St., Cambridge 42, Mass.



NEW EQUIPMENT, conf. . .

termined hydraulic pressure of the system is approached. It then automatically slows down to the speed necessary to maintain the required hydraulic pressure in the system. Overloading is impossible and the device will maintain pressure as long as required.—Milton Roy Co., 1300 East Mermaid Lane, Philadelphia 18, Pa.



MEGANICALLY OPERATED: Vibrating Feeder

(150A) Employing mechanical vibration to give positive action and uniform conveying speed, a new line of vibrating feeders and conveyors known as Free-Flow is being produced by the Free-Flow Co. The design is said to give a balanced construction, equalizing action and reaction within the machine and thereby preventing transmission of vibration to the building. Both conveyors and feeders are said to be self-cleaning to the last particle, quiet in operation and low in power consumption. They handle chemicals, coal and other solids over any desired length, using a single drive, and can be used for either hot or cold materials conveyed horizontally, around corners and up inclines.

Sizes and capacities are available to suit users' requirements.—Free-Flow Co., 1530 North Gordon St., Hollywood 28, Calif.



FOR GRAPHIC PANELS:

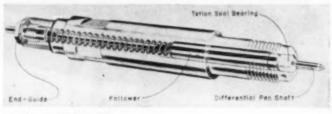
Miniature Recorder

To enable recording instruments to be substituted for the indicating instruments presently used on the new graphic control panels now being widely adopted in process industries, Taylor has developed a miniature recording-receiving instru-ment with a 3-in. strip chart. Known as the Transet, the new recorder serves a receiver for pneumatic transmission of flow, liquid level, pressure or temperature. The instrument fits into a panel opening of 3% x 4½ in. It comes in four forms, making possible various combinations of several functions, including one process record, set point indication, set point adjustment, valve position indication, and an automaticmanual unit for use with controllers located in the control house or field. -Taylor Instrument Cos., 95 Ames St., Rochester 1, N. Y.

WIDE-RANGE USE:

Plastic Packing

(150C) Raybestos-Manhattan has announced a new non-jacketed plastic packing called Versi Pak. Produced in (Continued)



METER STUFFING BOX

(150D) Pittsburgh-Equitable is now using a new high-pressure stuffing box on its orifice meters which requires no lubricant, is claimed to be leakproof at differentials up to 4,000 psi, and is virtually frictionless in transmitting float movement to the pen shaft. The secret of the design is the use of a Teflon seal bearing, on which a spring-loaded follower bears. Teflon permits a small amount of cold flow, thus securing perfect sealing, while it is wavy in character, climinating need for lubrication. The bearing is suitable for temperatures to 450 deg. F.—Pittsburgh Equitable Meter Div., Rockwell Mfg. Co., Pittsburgh. Pa.



Need a pump IN A HURRY?

Your mailed order or telephone call to our branch office for a Motorpump can usually be filled immediately from branch warehouse or factory stock.

If by chance, your order requires a special motor or special pump features, our local branch engineers will...



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Getting what you want, when you want it, is usually very important to a user of centrifugal pumps. The Ingersoll-Rand MOTORPUMP line is so complete and so flexible; that there is practically no limit to the number of combinations available to meet your precise requirements.

The standard line includes close-coupled pumps (motor or turbine drive), cradle-mounted pumps and condensate return units. Over 200 basic stand-

ard units are available with optional features and modifications to meet your special requirements. For further information, telephone, wire or write today for complete details.



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MOTOR PUMP

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STANDARD MOTOR, with current peak less than 40% of direct connected (special) motor drives. UNIFORM TORQUE. adjustable application. ACCURATE SPEED CONTROL. with simple and convenient adjustment, These features, and the inherent design of

These features, and the inherent design of the Roberts Fluid Drive Centrifugal, (which permits special characteristics to be incorporated easily, thus suiting it exactly to your individual application) call for investigation. Don't reject the idea of applying centrifugal force until this investigation is made. Your inquiry will have our full and prompt attention.



NEW EQUIPMENT, cont. . .

two forms, black for general services and white for special services, the new packing is said to conform readily to the shape of the stuffing box, to have greater density than woven or braided packings and to be more resilient than die-formed packings. It is claimed to be suitable for an exceptionally wide variety of applications and to give long service, increased operating efficiency, and a continued effective seal.—Raybestos-Manhattan, Inc., Packing Division, Manheim, Pa.



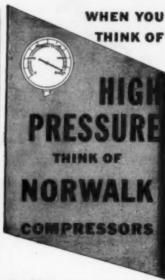
IMPROVES HEATING:

Steam Circulator

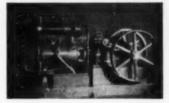
(152A) For those types of steam heated devices that have horizontal heating surfaces, such as horizontal pipe coils and platens, Sarco Co. has developed a steam circulation system which under proper circumstances gives considerable increase in heat transfer rates, thereby reducing the necessary steam consumption. For example, in one installation involving horizontal heating batteries, the use of the circulation system increased the equipment temperature from 240 to 290 deg. F., yet enabled steam pressure to be reduced from 125 to 90 psi.

The new system consists in employing in combination a small ejector of special design and a float type steam trap. The principle can be understood from the following facts: In the case of horizontal heat transfer surfaces, the condensate-air film tends to be sluggish and to present a high resistance to heat transfer. If increasing the steam velocity (as by bypassing the steam trap and supplying excess steam) will produce a turbulent flow condition in the condensate-air film. then heat transfer can be materially increased. A similar result can be obtained without waste of steam by introducing excess steam to the heat transfer surfaces, but recirculating the excess rather than venting it around the trap. In the new system this recirculation is accomplished by the small ejector.

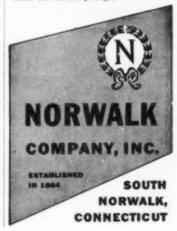
Here incoming steam loses some of (Continued)

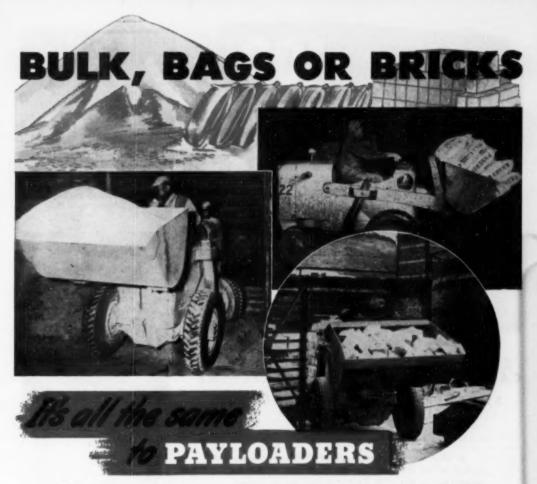


TANDEM COMPRESSOR



Four stage Norwalk compressor on steel base, for handling such gases as air, oxygen, hydrogen, helium, erhylene, natural gas, mixtures for synthetic purposes. The metal in the main cylinder shell is distributed to obtain the highest possible cooling efficiency from the water jackets which completely surround the cylinder bores and all air passages.





"PAYLOADERS" are designed to handle all bulk materials encountered in the chemical and fertilizer industries. Thousands of them are at work in these industries at these tasks reducing costs, increasing production and adding flexibility to operations.

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high or low, slow or fast - by means of controlled hydraulic power.

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G. HOUGH CO



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For severe pulsation services, order your Helicoid gages with snubber cartridges in the socket. Or, order complete snubbers separately. Specify for water, air or oil; "" or ""; bronze or stainless steel.



NEW EQUIPMENT, cont. . .

its pressure in compressing the excess steam that has completed the circuit, and in recirculating it. The illustration above shows such an installation. Incoming steam enters the ejector, flows through and enters the heat transfer coil. Excess, uncondensed steam leaving the coil is separated from condensate in a separating fitting, returning to the ejector. Condensate, however, leaves by means of the float type steam trap. Not all installations can use this system effectively, but the manufacturer believes that many designs can be materially improved in this way.-Sarco Co., Empire State Bldg., New York I, N. Y.



SEPARATES MICRON PARTICLES: Fine Material Classifler

Under license from En-(154A) koping Verkstader of Sweden, the Harry W. Dietert Co. is now prepared to manufacture, market and service the Bacho micro-particle classifier, a device for making precise separations of fine particles in the range from zero to 100 microns. A sample of fine material may be divided into eight or more particle size fractions by passing it through the classifier, with each particle size caught in a smooth container to permit weighing and determination of the percentage of that particular size material. The instrument may be used to determine the fineness of smoke particles, industrial dusts, pigments, cements, chemicals and other finely ground materials. It operates on an adaptation of the Stokes law principle, employing an air centrifuge with particle sizes separated by air velocities. A 1-hp. motor drives a rotor which produces a homogenous gyratory air field. This field is quickly changed for separating out chosen particle sizes. An analysis of eight separations can be made, it is said, in about 2 hr. without a highly skilled operator. — Harry W. Dietert Co., 9330 Roselawn Ave., Detroit 4, Mich.



LEAK-PROOF, PACKLESS:

Rotary Pressure Joint

(155A) For the handling of steam and other fluids at both high and low speeds and temperatures, Phillips Rotary Joint & Valve Co. is offering a flexible rotary pressure joint which is said to obtain a perfect seal without use of packing. The joint is made in sizes from 1 to 3 im., in both 90-deg, angle and straight types. It is said to employ the greatest possible bearing surface on precision lapped seats. A newly patented spiral groove on the rotating member is said to prevent possible leakage between the sealing surfaces.—Phillips Rotary Joint & Valve Co., 730 Grand St., Hoboken, N. J.



SENSITIVE, PRECISE:

Pneumatic Controllers

New air-operated controllers for temperature, pressure, liquid level and flow, which are said to be sensitive, precise, and fast in operation, have been announced by Penn Industrial Instrument Corp. These Industrial Instrument Corp. controllers can be supplied with any of the usual control functions, such as on-off, proportional control, automatic reset, and derivative action. For flow control, the company's Magna Clutch method of transmission between minometer and meter mechanism is used, eliminating stuffing boxes and pressure-tight bearings. An important feature of the new controllers is their use of sapphire jewels for both nozzles and restriction to prevent wear due to (Continued)



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If you're on a merry-go-round about handling air or gas, R-C dual-ability can help you.

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chemical processing, with capacity of



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ONE OF THE DRESSER INDUSTRI

NEW EQUIPMENT, cont. . .

dirt, water or oil in the air. The nozzle is not adjustable. An easily accessible cleaning lever is provided for cleaning the restriction while the controller is in service.—Penn Industrial Instrument Corp., 3116 North 17th St., Philadelphia 32, Pa.



COMPACT, CORROSION RESISTING:

Rubber Pinch Valve

(156A) U. S. Rubber's latest development is a rubber pinch valve for applications involving corrosion or abrasion. The valve requires no packing, absorbs vibration, eliminates water hammer and is flexible enough to offset misalignment in the pipes. It can handle solids in suspension, as well as corrosive chemicals. Various sleeve compositions are employed, depending on the service. clude corrosion and abrasion resisting compounds, neoprene for oil resistance, Butyl rubber for high heat and severe acid conditions and pure gum stock for foods and beverages. United States Rubber Co., Rockefeller Center, New York 20, N. Y.



ACCURATE, PORTABLE:

Tubing Cutoff Machine

(156B) To simplify the installation of stainless steel tubing by cutting to length at the point of use, Gilman Engineering & Mfg. Corp. has developed a portable stainless tube cutoff machine capable of handling any diameter from 4 to 24 in. with an accuracy within 0.010 in. Since torch cutting affects the tubing properties adversely (Continued)

The Word is con-tin'u-ous

"...without cessation or interruption"...Webster's Dictionary

The Method is



Why De Laval?

De Laval has over 70 years experience in solving problems of separation and clarification. Your problem may be quite similar to one that has already been solved by De Laval centrifugals. It will pay you to ask.

DE LAVAL CENTRIFUGALS

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- -for the Aseparation of two liquids plus the continuous removal of solids from one or both

All De Laval machines have one basic advantage in common—they all speed up processing operations by making them continuous. By making most effective use of centrifugal force to separate or clarify liquids, these machines eliminate costly delays that gravity or inefficient filtration methods require. De Laval centrifugals do in a few seconds work that otherwise would take minutes or even hours.

De Laval has available so many different types and sizes of machines that there is always one that meets your particular needs best. Ask a De Laval engineer to call.

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CENTRIFUGALS

for Speeding Production by

Separation and Clarification



Leading manufacturers of pencils and crayons have applied the Wet Milling MIKRO-PULVERIZER to grinding their clay-graphite and color sludges. It had been previous practice to ball mill this sludge.

In one plant the former procedure had been to run a batch of about 150 gallons in ball mills requiring a total of 25 h.p. for a period of more than 50 hours. The same finished product is produced in a Wet Milling MIKRO-PULVERIZER in 8 hrs. using 10 h.p.—1250 h.p. hrs. compared to 80 h.p. hrs.

The Wet Milling MIKRO-PULVERIZER has found a considerable use in the

Also evaliable for Dry McRing, our full line of MKRO-ATOMICES and MKRO-ATOMICES nated for forecopy blooming and precise per-tide control...grinds from granufer to obtain in fewer micron range...copacities from 75 to 25,000 fbs. par heart. For complete resevery of solids and dimination of industrial dust, forecatigue and MKRO-COLLECTOR.

See the MIKROS on display Beeths 52 and 33 National Chemical Especifion Calissum, Obicago Supt. 5-9 food products field, color and dyestuff industry, as well as for pharmaceutical cintments and the chemical, clay, cosmetic and insecticide industries. It is equally successful on both pastes and slurries. For grinding solids in suspension, or subjecting the material to an intensive mixing action—the MIKRO generally will do either, and do it better with less power.

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NEW EQUIPMENT, cont. . .

and the hacksaw method is slow, this new abrasive wheel method is said to save much time without undesirable effects on corrosion resistance. This concern has also developed an attachment to the machine which permits circumferential butt welding of tubes of any diameter up to 24 in. by an inert gas welding process.—Gilman-Engineering & Mig. Corp., Janesville, Wis.



TWO-MAN KIT: Supplied Air Respirator

To enable two workmen such as maintenance men, to work simultaneously in an area of insufficient or objectionable atmosphere, Scott Aviation Corp. is now providing a two-man portable respirator kit of the supplied air demand type, comprising a carrying case and two complete installations consisting of air hose and a full-vision face mask. The carrying kit contains a filter and pressure reduction equipment. To use, it is simply necessary to connect to a plant air line or to a supply of bottled air. The new respirator kit carries Bureau of Mines approval. - Safety Equipment Division, Scott Aviation Corp., Lancaster, N. Y.



DISCHARGES POSITIVELY:
Hopper-Discharge Valve

(158B) For continuous withdrawal of dust or powdered materials from collection hoppers, Buell Engi-

July 1950-CHEMICAL ENGINEERING

neering Co. has developed a new double-gate hopper-discharge valve said to be positive in operation. The valve consists of a pair of chambers secured one above the other. In the upper portion of each chamber is a hinged gate which is normally closed. A rotating cam driven by a small gear-reducer motor alternately opens first one gate and then the other. The closing shock of the gate automatically shakes loose any clinging material. The valve's discharge capacity is 103.2 cu.ft. of dust per hr.—Buell Engineering Co., 70 Pine St., New York 5, N. Y.



SLEDE TYPE: Quick Opening Valve

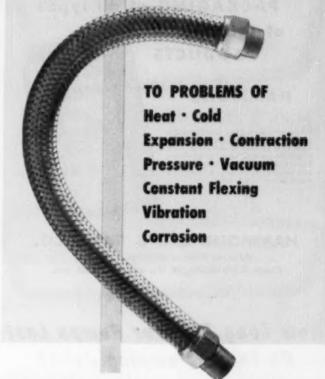
Made in stainless steel for chemical and similar applications is a new line of quick-opening sleeve valves in sizes of 1, 13 and 2 in. These valves are seatless and make use of neoprene O-rings for sealing. They operate at pressures to 100 psi, and are claimed to be leakproof without metal-to-metal contact. They are said to give full flow, to be sanitary and self flushing. easy to maintain, light in weight and self-lubricating. They are made in types 304 and 316 stainless, with coupling ends or any standard or special thread desired. The same concern is producing a quick-disconnect hose coupling also using neoprene O-rings for sealing. These couplings disconnect by hand without tools and are suitable for pressures to 250 psi. They come in the same sizes and materials as the valves .- J O Mfg. Co., Southgate, Calif.

COMPACT, PORTABLE:

Research Rotameters

(159B) For wide range flow measurement in research, pilot plant and field work, Brooks Rotameter Co. has developed a compact, portable kit having three integral metering tubes with two special floats for each tube, made of Pyrex and tantalum. The (Continued)

Economical Answer



Titeflex All-Metal Flexible Tubing

If you use tubing to convey gases, liquids or semi-solids, chances are Titellex can help you do it better, at less cost. There's a type of Titeflex for almost every need—and all Titeflex is all-metal, to last longer in any kind of service. Get the facts. Write for complete catalog.

- * Five metals brass, branze, stainless, monel, inconel
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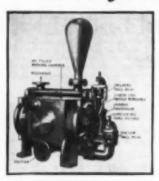
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500 Freilinghuysen Avenue . Newark S. New Jersey

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How Long Do Your Pumps Last On Tough Pumping Jobs?



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√ No Leakage—No Loss.

√ No Wear on Working Parts.

V Costs Less to Operate.

¥ Easier to Maintain.

Do you ocrap the pumps you use on corrosive or abrasive materials after a few weeks or months? Or do they require frequent reconditioning at great expense?

conditioning at great expense?

Such tough service is rough on ordinary pumps. But with the Shriver Diaphragm Pump it's another story because it's built to handle such materials. Hundreds of service reports show that when properly (and casily) maintained, it outlasts ordinary pumps many times.

For example, how long do you think any one of the many types of pumps offered would last on hot glue and emery? Daysmaybe a few weeks, at best. But 21 Shriver Diaphragm Pumps on this very hard service show an average annual cost for replacement parts and maintenance of less than 6% of the pumps' first cost. It will pay you to look into how the

It will pay you to look into how the Shriver Diaphragm Pump can help you out of your pumping troubles. Get Bulletin 126.

Get a copy



T. SHRIVER & COMPANY, INC.

NEW EQUIPMENT, cont. . .

meter gives an overall range from 0.1 cc. per min. to 0.5 gpm. of liquid, and 5 cc. per min. to 2 cfm. of air. Fittings are available in a variety of corrosion resisting metals and non-metals.—The Brooks Rotameter Co., Box B-2550, Lansdale, Pa.

EASILY CLEANED:

Stainless Shovels

(160A) For chemical handling, Metalsmiths has developed a line of scoop and square point stainless steel sanitary shovels designed to eliminate all lodging places that might trap materials handled. For example, all crevices are filled in and all welds are ground smooth and polished all over. —Metalsmiths, 560 White St., Orange, N. J.

PULL BOBIES, RESILIENT

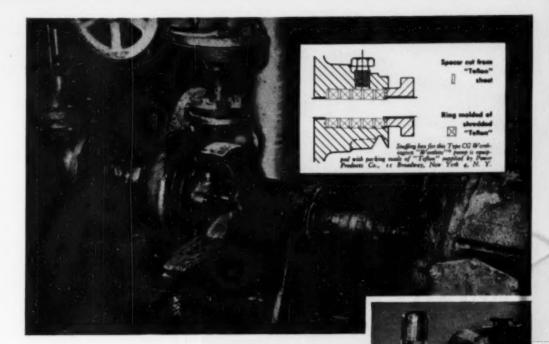
Dynel Filter Cloth

(160B) Dynel, the new spunstaple Vinyon N fiber, is now being produced as a filter cloth under the name of Feon Dynel by Filtration Engineers. Because the cloth is of spunstaple rather than continuous filament, it is full bodied and resilient, making it easy to seal without requiring excessive rim pressures. Such fabrics are said to be remarkably acid-resistant and are especially recommended where hot acids are filtered. They are also resistant to alkalies, bacterial action, and a (Continued)



HYDRAULIC DRUM FORK

(160C) Towmotor's newest fork truck improvement enables the same forks to be used for ordinary pallet handling operations and for handling steel drums without pallets. This is accomplished by placing concave notches on the inside edges of the forks to give cloue contact with the sides of the drums, and providing a double-acting hydraulic cylinder to move the righthand fork laterally, while the lefthand fork is anchored in a stationary position. The drums are thus picked up between the forks and supported on the rolling rings.—Towmotor Corp., 1226 East 152nd St., Cleveland 10, Ohio.



PACKING OF DUPONT TEFLON" LASTS UP TO 300 TIMES AS LONG

as conventional packing in pumps handling highly corrosive chemicals

"We use pumps to handle furning sulfuric acid and used to repack them every two daya," reports one manufacturer. "In 1947, we packed our pumps with 'Teflon,' We haven't had to repack them since." This is a typical example of the extraordinary chemical-resistance of Du Pont "Teflon" tetrafluoroethylene resis.

In addition to withstanding the attack of practically all chemicals except molten alkali metals, "Teflon" exhibits remarkable heat-resistance . . . can

be used over a temperature range of -320 F, to 500 F. These characteristics, plus its extremely low coefficient of friction, account for its outstanding performance in packing in the pumping of corrosive chemicals. In many cases "Teflon" has far outlasted any other packing material tried.

"Teflon" is supplied by Du Pont in standard shapes (rods, tubes, sheets and tape). Or we will recommend molders or fabricators who can supply finished parts of "Teflon." HERE YOU CAN ACTUALLY SEE the packing of "Tefton" in a small proportioning pump with a striffing box of Du Pont "Lucite" acrylic resin. Like the packing in the Worthsington pump, this packing consists of rings of molded shredded "Tefton" (dark rings and spacers cut from "Tefton" sheets (white rings). Pump is manufactured by Proportioneers, Inc., 29 Codding Street, Providence 1, R.L.

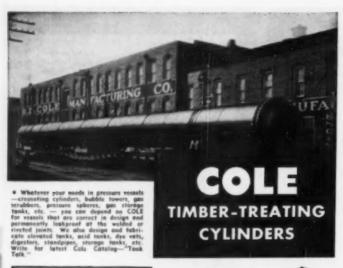
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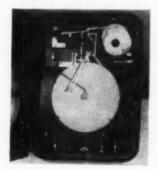
NEW EQUIPMENT, cont. . .

variety of organic solvents.—Filtration Fabrics Div., Filtration Engineers, Inc., 155 Oraton St., Newark 4, N. J.



Jacketed Control Valve

Developed primarily for handling molten sulphur at 275 deg. F. to rotary sulphur vaporizers used in the sulphite pulp industry, a new jacketed control valve developed by G. D. Jenssen Co. is also suitable for handling other molten materials, such as asphalt, wax, resins, and other thermoplastic or viscous materials which must be heated in transit. The valve body is completely steam jacketed. The chrome nickel seat is removable and the chrome nickel stem is lubricated. The valve may be operated from any standard air-operated control instrument. For safety, it is normally of the air-to-open type. Sizes are presently available from 1 to 1 in .-G. D. Jenssen & Co., P. O. Box 401. Watertown, N. Y.



USES ADJUSTABLE CAMS:
Program Controller

(162B) To eliminate cam cutting, Gotham Instruments has developed a program recorder-controller which has a standard set of cams that can easily be adjusted to the conditions required, or readily changed when necessary. Thus, a predetermined (Continued) control program with relation to temperature or pressure can easily be worked out. The cams control the rate rise and length of hold, while the holding temperature is changed by turning a knob for setting the control temperature. The instrument uses a 9-in. circular chart and is housed in a 12-in. case.

With little effort and expense, the controller can be modified to control two variables at once; to reset automatically after completion of a cycle; to stop the cam at any critical point in the cycle; or to provide for the addition of signalling devices or air or electric relays or switches.—Gotham Instruments Div. of American Machine & Metals, Inc., 149 Wooster St., New York 12, N. Y.

Foam Fire Fighter

(163A) Now available from American-LaFrance-Foamite is a new extinguishing agent, Foamite Aairfoam liquid, which is a specially treated protein of vegetable origin compounded with additives to control viscosity, lower the freezing point and improve foaming properties. Six percent of this liquid, with 94 percent of water, and foamed with air, forms a thick, stable foam blanket at the rate of about 170 gal. of foam for each gallon of liquid.—American-LaFrance-Foamite Corp., Elmira, N. Y.

Plastic Lined Drums

(163B) Use of the Schori flame spray pistol has permitted the development of a new line of 30- and 50-gal. Hackney open-head seamless barrels, lined with polyethylene in thicknesses of \$\delta\$ and \$\delta\$ in. Drums with the thinner lining are priced lower than comparable rubber-lined drums. The resulting coating is said to be permanent, making the drums returnable for indefinite use. The coatings are resistant, it is claimed, to practically all chemicals.—Schori Process Division, Ferro-Co Corp., 8-11 43rd Road, Long Island City 1, N. Y.

Corrosive Liquid Meter

(163C) The Hays Veriflow meter, as well as the Veritrol for controlling liquid flow rates, is now made in a design suitable for the handling of corrosive liquids including salts, organic acids, alkalies and mineral acids such as phosphoric and strong sulphuric. The meter is of the positive-displacement, nutating-disk type, with a totallizing register, plus a (Continued)

METAL PLANT

owner estimates savings of \$7690 per year with Pangborn Dust Control

ASBESTOS PRODUCER

reports profit of \$20 a day with Pangborn Dust Control.

FOOD PROCESSOR

writes Pongborn Dust Control saves him \$30.48 per year.

CARBON PRODUCER

reports \$1471 yearly profit with Pangborn Dust Control.

CHEMICAL MFGR.

states Pangborn Dust Control saves him \$14,859 a year.

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\$50 saved each day with Pangbarn Dust Control.

WOOD FABRICATOR

estimates \$875 saved every year with Pangborn Dust Control.

REFRACTORY

executive reports savings of \$4318 per year with Pangborn Dust Control.

RUBBER PLANT

owner reports \$100 profit each month with Pangborn Dust Control.

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PANGBORN DUST CONTROL
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As these authentic cases from Pangborn's files show, Pangborn Dust Control stops dust at a profit! Even where dust can't be sold or re-used, Pangborn users report impressive savings from \$1200 to \$7000 and more a year.

And where dust is valuable (made up of products or raw materials), annual savings of \$12,000, \$13,000 or \$14,000 a year are not uncommon for Panghorn installations.

FIND OUT NOW MUCH YOU CAN SAVE! A Pangborn Dust Survey costs nothing—but will show you how you can term the dust in year plant into cash savings. For details, write the PANGBORN CORPORATION, 283 Pangborn Blvd., Hagerstown, Maryland.

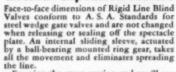
Look to Pangborn for the latest developments in Dust Control and Blast Cleaning Equipment.





Hamer RIGID Line Blind Valves solve the problem of effecting a positive blind shut-off in piping installations where endwise movement of the line is impossible. Now, for the first time, the advantages of the safe, speedy, one-man operated Hamer system of blinding can be incorporated in rigid pipe lines and manifolds in refineries, process plants, and on ship board, as original equipment in new installations, or as replacement of existing valves.

New Internal Expansion Feature



Examine the cross section and you'll see these other important features. • Enclosed plate side—eliminates loss of product, mess and fire hazard for fluid can't spill while plate is being reversed. • Rigid body—unaffected by misalignment or line strains. • All working parts enclosed—packed in grease for smooth action; sealed against line fluid. • Positive shub-off or full-open fluid passage—There's nothing like a Hamer Line Blind Valve for positive action, easy operation, long service and SAFETY.



NEW EQUIPMENT, cont. . .

direct-connected generator for indicating flow rate. A contact-making relay is added, together with a motoroperated valve, in the controlling version of this instrument.—The Hays Corp., Michigan City, Ind.

Temperature Instruments

(164A) Long associated with the flow measurement field, Fischer & Porter is now producing instruments for measuring, indicating, recording and controlling temperature and pressure. The temperature instruments, named Ratotherm, cover ranges from —125 to +1,000 deg. F. The pressure instruments, named Ratogage, cover ranges from 30 in. Hg vacuum to 10,000 psi.—Fischer & Porter Co., Hatboro, Pa.

Process Valve Disks

(164B) Valve disks, produced from various kinds of steel, are now available as replacements for a wide range of valve types used in oil, gas and chemical industries. Produced by a series of operations involving removing impurities from the steel, blanking, hardening, tempering, Magnafluxing, flattening, grinding and finishing, the disks are guaranteed against warping and excessive breakage.—Tri-State Mfg. & Engineering Co., Indianapolis, Ind.

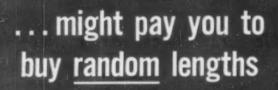
Non-Slip Coating

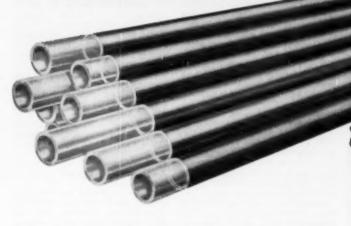
(164C) Under the name of Dyna-Grip, Merchants Chemical Co. is marketing a new non-slip coating which can be applied to damp or dry surfaces, wood, concrete or metal (except galvanized iron). This coating is said to be unaffected by temperature changes, while it is a non-conductor of electricity and resistant to acid, alkalies, gasoline, oil, grease and salt water. It is a formulation of abrasives suspended in a thermoplastic resin solution.—The Merchants Chemical Co., Elm Court, Stamford, Conn.

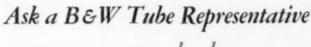
Small Aftercoolers

(164D) Customarily, aftercoolers for compressors have been available only in the larger sizes. The new Murphy Type V-907 aftercooler is now produced in two small sizes for 20, and for 30 to 50 cfm. of free air. The new design is a scale-down of the larger aftercoolers of this manufacturer, with careful provision for the separation of condensed moisture.—Jas. A. Murphy & Co., Hamilton, Ohio.

-End







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TA-1573GR

New Products and Materials

JOSEPH A. O'CONNOR, Neses Editor

POR DESTAL PREME

Hammer-Effect Finish

(166A) A new one-coat hammer-effect finish, known as Un-i-loid, which may be sprayed on metal items at the same pressure as regular enamels, has been perfected by the United Lacquer Manufacturing Corp.

Research that produced Un-i-loid was begun when manufacturers complained that the hammer effect obtained with previously available finishes varied with the techniques used by different sprayers.

This difficulty has been overcome by Un-i-loid, United Chemists report. One coat of the new enamel, when sprayed at standard enamel pressure, immediately produces a hammer effect with a smooth, lustrous appearance. Good results have been obtained, they say, in extensive tests on oil burners, refrigeration equipment, sanitary containers and other metal items.

Un-i-loid is available in a full range of colors, and is available in either a bake or an air-dry finish.

Baking time at 300 deg. F. is 20 min. in a gas oven, or 8 min. under infrared lights. Air-dry Un-i-loid is dust free within a few minutes and can be handled within an hour. It will dry hard overnight.—United Lacquer Manufacturing Corp., 1001 West Elizabeth Ave., Linden, N. J.

PRICES CUT:

Surface-Active Agents

(166B) A price reduction of 3 to 5 c. a lb. on four of Monsanto Chemical Co.'s non-ionic surface active agents has been announced.

Sterox SE and SK, both 100 percent active, are now 31 c. a lb. in tank car quantities. Sterox No. 5 and No. 6, their respective 85 percent active products, are 27 c. a lb. Corresponding decreases on smaller lots also have gone into effect.

Both Sterox SE and SK are clear pale yellow liquids stable in hard water and in acid or alkaline solutions. They are said to be compatible with builders such as phosphates or carbonates, and with anionic and cationic type detergents, both soaps and synthetics. Chemically, the products are polyoxyethylene thioethers.

Sterox SE and Sterox No. 5 are de-

signed for use where maximum solubility and clarity of solution are desired in applications requiring a high degree of surface activity or detersive action over a wide range of concentrations and temperatures in hard or soft water.

Sterox SK and Sterox No. 6 are used for their very fast wetting action, good emulsifying properties and high level of detergency.—Monsanto Chemical Co., St. Louis 4, Mo.

INTERMEDIATES: Isobutyl Amines

(166C) Sharples Chemicals Inc. announces that isobutylamine and dissobutylamine are available for the first time in semi-commercial quantities. Commercial production can be initiated if demand warrants.

Isobutylamine, (CH₀),CHCH₀NH₀, has a molecular weight of 73.1. It is water-white, has a specific gravity at 20 deg. C. of 0.73-0.74. The product contains a minimum of 97 percent amine. It starts boiling at 64 deg. C., with 95 percent distilling between 64 and 71 deg. C. Final boiling point is 75 deg. C. Flash point is less than 20 deg. F. Viscosity at 60 deg. C. is 0.33 centipoise.

Diisobutylamine (MW, 129.2) has

as its formula [(CH_e)_e CHCH_e]_e NH. Also water-white, its specific gravity at 20 deg. C. is 0.74-0.75. The product consists of a minimum of 98 percent of the amine. Distillation range is 134 to 141 deg. C. Flash point is 85 deg. F., and viscosity at 60 deg. C. is 0.44 centipoise.

These two chemicals are promising intermediates for use in the agricultural, petroleum, pharmaceutical, plastics, rubber and textile industries. Samples and prices are available from the producer. — Sharples Chemicals Inc., 123 South Broad St., Philadelphia 9, Pa.

FOR POLYSTYRENE:

Anti-Statle Agent

(166D) A new anti-static and cleaning agent developed specifically for polystyrene moldings, film and other articles is now being manufactured by the Chemical Development Corp. Called Anstac PS, it is an inexpensive, highly effective, fast drying lionid.

The treated product is completely anti-static, thus eliminating the attraction of dust and dirt that spoils the appearance of polystyrene and causes scratches. Anstac PS has a



CLEAN SWEEPDOWN, BUT NOT FORE AND AFT

(166E) Philadelphia launched its annual "Clean-Up, Paint-Up, Fix-Up" campaign recently by dispatching this task force of two street-cleaning flushers to spray a stretch of Broad St. in the heart of the city at noon with a mixture of water and Ultrawet, a synthetic detergent made by the Atlantic Refining Co. The heavy foam created by the solution attracted the attention of thousands of pedestrians. The city used the Ultrawet solution every night for the rest of the mouth to clean the central city streets, from Walnut to Arch and from Fourth St. to the Schuylkill River.—Atlantic Refining Co., 260 South Broad St., Philadelphia, Pa.

high affinity for polystyrene and will last almost indefinitely under normal handling. It is water resistant but may be removed if desired by hot water and soap. Samples and additional technical data can be secured from the manufacturer. — Chemical Development Corp., Danvers, Mass.

FOR VINYLS:

Pair of Stabilizers

(167A) Claiming outstanding heat and light stability, clarity and improved life of product, Advance Solvents & Chemical Corp. announces two new stabilizers for the vinyl plastics industry.

First of these is Stabilizer S No. 52, a new organo-tin stabilizer that yields outstanding heat and light stability in all types of vinyl chloride and copolymer resins and notably improves clarity. It is a low viscosity liquid that can easily be incorporated into resins. The stabilizer is therefore suited for transparent film work, including rigid vinyl sheeting.

The other new product is Stabilizer S No. 21, an ideal heat and light stabilizer for straight polyvinyl chloride polymers. It is a mobile, easily incorporated liquid. Stabilizer S No. 21 differs from the usual metal salt stabilizers in that it combines the stabilizing action of cadmium with a radical that is a powerful acid accepter.—Advance Solvents & Chemical Corp., 245 Fifth Ave., New York 16, N. Y.

HOT-PRESSED:

Synthetic Mica Ceramic

(167B) A new ceramic material consisting of a fine-grained aggregate of synthetic fluorine-mica crystals has been produced by researchers at the Electrotechnical Laboratory of the U. S. Bureau of Mines in Norris, Tenn. The work was done under an Office of Naval Research contract. Bodies of very low porosity (less than 0.5 percent) are made by hot-pressing a finely powdered synthetic mica at temperatures 100 to 200 deg. C. below its melting point. So far, 92 cylindrical samples, 2 or 3 in. long and 1½ in. in diameter, have been made. Extensive X-ray diffraction studies have shown that the material consists almost entirely of mica.

One of the most interesting properties of this ceramic is its softness. What's more, it can be drilled, sawed, milled, threaded, turned on a lathe, or otherwise worked with machine or hand tools. A high degree of dimensional precision can be attained because the material does not require

further heat treatment after machin-

Other important characteristics of this ceramic are its good chemical stability and weather resistance. Samples exposed to the pressure of water vapor in a bomb at 600 deg. F. for two weeks have shown negligible changes in weight and no significant disintegration. This would appear to be a great improvement over the behavior of commercial glass-bonded natural mica products.

Composition of the material can be varied over wide limits. Most of the different fluorine-mica compounds may be made in the form of a hot-pressed ceramic. This means that a high degree of latitude and control of the various properties of the material are possible. The properties may be varied still further by the introduction of other compounds such as oxides, silicates, fluorides, carbides and graphite.

Dielectric properties of the new ceramic have been studied at the Squier Laboratory of the Army Signal Corps. The dielectric constant at 1 megacycle ranged from about 5.5 to 7.0. The best value for the dissipation factor was about 0.012, loss factor 0.067. These values by no means indicate the best that can be expected from the material. All samples so far were made in graphite dies and were distinctly gray-colored throughout due to carbon contamination. Presence of even a little carbon in such a body has a very detrimental effect on the dissipation and loss factors.—U. S. Bureau of Mines, Electrotechnical Laboratory, Norris, Tenn.

FOR ELECTRICAL USES: Silicone Resins

(167C) Two new General Electric silicone resins for electrical applications have been announced.

One, designated GE silicone insulating resin No. 81132, is a flexible resin of good drying speed. It is tough, fast-drying without a catalyst, has excellent build on glass cloth, and good heat life. It is intended for use as a coating on glass cloth and glass sleeving, and as a sticker for micaglass tape and other flexible mica products. It is supplied as a 60 percent solution in toluene.

The other new resin is designated GE silicone resin No. 81145 and is supplied as a 50 percent solution in petroleum spirits. It was designed for bonding and impregnating motors, generators, and transformers requiring Class H insulation. However, it may be used in bonded mica tape, and glass combinations. When example 1.

treme flexibility is not desired it can be used effectively as a coating for glass cloth and sleeving. When propcrly cured it is a relatively hard resin but maintains a high degree of flexibility. It will through-cure readily and develop good bonding properties at elevated temperatures. It is to be used as furnished; no catalyst is necessary.—General Electric Co., Chemical Department, Pittsfield, Mass.

RESIST CHEMICALS:

Concrete Floor Enamels

(167D) Hysol concrete floor enamels, new materials for protecting concrete surfaces from acids and other chemicals, have just been developed by Houghton Laboratories Inc. Claimed to offer outstanding abrasion and wear resistance under all circumstances, these chemically inert enamels resist (Continued)

More Information . .

To find out more about any of these new products, circle the item's number on Reader Service Postcard inside the front cover.

This Month . . .

Ever plagued by the problem of separating alcohols from non-alcohols? Turn to p. 168 and learn about citraconic anhydride. Its reaction with alcohols permits such a separation. . Manufacturers of protective coatings will be interested in the unsaturated secondary alcohol described on p. 170. Polymers made from it provide good coating vehicles . . on p. 174 you'll learn about a new accelerator activator for natural and synthetic rubbers. This activator is designed for use with thiazole and thiuram primary accelerators. . Two improved brush killers are described on p. 176. They have a higher equivalent actic content and lower volatility. . Finally, you may be interested in the new pump fluid, p. 176, for diffusion pumps in high-vacuum

Next Month . . .

BETTY OF

Among new products to be reported on will be a new resin for paper manufacturers. It imparts great wet strength to paper. . Also watch for the story on two white lead pigments that are non-reactive to vehicles containing free carboxyl groups.



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GRASS KILLER GOES TO MARKET

(168A) Demand for the new sodium trichloroacetate perennial and annual grass killer has grown steadily since the product was first used commercially in 1949. To keep pace, Dow Chemical Co.'s agricultural chemical division has expanded its Sodium TCA production facilities 90 percent. This is a packaging unit in Dow's enlarged plant. Here Sodium TCA from the hopper is screened and weighed into the fiber drums in which it is shipped.—Dow Chemical Co., Midland, Mich.

NEW PRODUCTS, cont. . .

the action of mold growth, gases and chemicals such as 10 percent concentrations of commercial acids and alkalis that ordinarily deteriorate concrete floors and walls.

Odorless and non-contaminating when dry, Hysol enamels are applicable by conventional brushing methods. They are available in iron red, gray and green. Average coverage is 350 sq. ft. per gal. with a single coat satisfactory for most installations.

Hysol concrete floor enamels are solutions of inert synthetic resins with outstanding thermal stability, chemical stability and resistance to wear and abrasion. Non-oxidizing and fast drying, they provide a tough, non-porous film that will not saponify. Tests have shown that these coatings easily resist the action of such things as 5 percent sodium hydroxide, ammonium hydroxide, motor oil, corn oil, butter, oleic acid, phosphoric acid and nitric acid.

Houghton Laboratories, Inc., Olean N. Y.

Citraconic Anhydride

(168B) A chemical of potential commercial importance is citraconic anhydride. Smith-New York Co., Inc., has been pushing work on it in laboratory and pilot-plant stages. Research chemists will be interested in its reactions with amines, dienes and alcohols. Chemical engineers and in-

dustrial chemists will be interested in its use for separating alcohols from non-alcohols, as well as in its use in the plastics field.

Citraconic anhydride is a white liquid of extremely high density and is easily handled. It freezes when cooled in ice; it melts at 6 deg. C. and boils at 213 deg. C. It is one of the densest organic liquids not containing halogen atoms.

Citraconic anhydride has the remarkable property of being stable in the presence of water in a reversible reaction. It reacts readily with water, and at room temperatures the resulting acid, citraconic acid, is very soluble and is stable. The mixture, however, can be distilled to obtain water and citraconic anhydride. This property is to a degree true of all cis-dicarboxylic acids; however, citraconic anhydride represents the extreme condition.

In water, citraconic anhydride hydrolyzes more slowly than itaconic anhydride. Being a liquid, it is more soluble in many organic solvents, and this permits in certain cases higher concentrations in its use as compared with maleic anhydride.

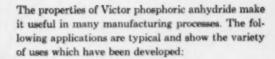
With cold water, citraconic anhydride forms two layers, and they may be easily separated owing to the high density of the anhydride. This permits separation following regeneration from aqueous solutions. The reaction of the anhydride with water is not energetic.

While it is more expensive than (Continued) HIGHLY REACTIVE
PHOSPHORIC
ANHYDRIDE...

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VERSATILE
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GAS DRYING AGENT - RADIO TUBES



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Typical Reactions of Victor Phosphoric Anhydride

RCOOH + R'OH + P,O, - RCOOR' + 2HPO.



CATALYST - ASPHALT IN IRRIGATION DITCHES



ORGANIC PHOSPHATES-INSECTICIDES



REAGENT IN METHYL METHACRYLATE RESINS

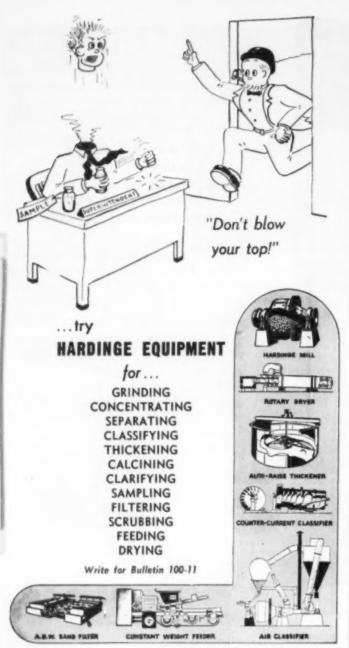


VICTOR CHEMICAL WORKS

141 WEST JACKSON BOULEVARD . CHICAGO 4, ILLINOIS



A. R. Maas Chemical Co., Division 4570 Ardine Street, South Gate, California



HARDINGE

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New Products, cont . . .

phthalic and maleic anhydrides, where advantages of citraconic anhydride are apparent the additional cost is overcome by its ease of regeneration and re-use. This results in a low-cost chemical. At temperatures of 100 deg. C. and over, it apparently exists in equilibrium with hot water, the anhydride being favored. Thus, if cooled, the anhydride layer may be separated from the water layer before it is hydrolyzed.

The anhydride reacts with primary amines to yield crystalline products; however, with secondary and tertiary amines, the products are not usually crystalline. It reacts with alcohols without a catalyst to form unstable half-esters. This is the basis for the separation of alcohols from non-alcohols. It reacts with conjugated double bond systems in the Diels-Alder reaction to form adducts. This suggests uses in the production of compounds with angular methyl groups and in the separation of diene systems from either moieties.

Most unique property of citraconic anhydride is the fact that because of its physical structure and arrangement, its reaction products tend to decompose to yield back citraconic anhydride. The monoamide, for example, hydrolvzes in water almost immediately to the ammonium salt of citraconic acid. Some monoamides upon distillation yield back the amine and citraconic anhydride. Monoesters decompose upon distillation and give the original alcohol and the anhydride. The diesters, however, are stable.

The citraconic moiety imparts a high refractive index to its liquid derivatives. Esters of this and its related compounds in plastics are clear and very satisfactory. The amides are very soluble in water.

Smith-New York has prepared many derivatives of citraconic acid, including salts, esters, acid chloride, and amides. These may be purchased in experimental quantities. Additional technical data on citraconic anhydride is also available.—Smith-New York Co., Inc., Freeport, Long Island, N.Y.

UNSATURATED:

Dicyclopentenyl Alcohol

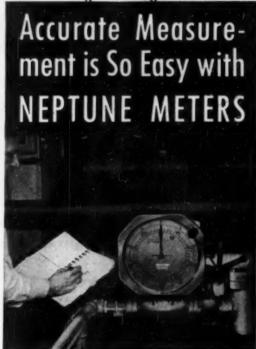
(170A) Pilot-plant quantities of dicyclopentenyl alcohol, an unsaturated secondary alcohol obtained by hydration of dicyclopentadiene, are now being offered by the Rohm & Haas Co.

This C₂₀ alcohol has a boiling point of 239-241 deg. C. at 773 mm. (without decomposition), a flash point of (Continued)



Neptune Meters are made for men who are hardboiled about profits and losses in liquid processing operations. Accurate Neptunes substitute unerring precision for the element of human error. They stop spoilage, spillage, and underfilling. They work fast—no slow weighing or batch tanks. Fineinstrument accuracy gives you constant control over product quality—and also keeps close watch over inventory.

They boost good house-keeping, too. Simple, easy to clean, they keep messy or hazardous liquids inside the pipe. Many types now available for handling more than 100 different liquids—including the new "432" push-button Auto-Stop for automatically feeding water and liquid sweeteners to batching or blending. Composition bronze. Sizes %" to 6", for rates to 600 gpm. Easy to read, easy to operate, easy to calibrate, and easy to service with interchangeable parts. For quick facts, just use the coupon. Or phone the nearest Neptune branch.



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Automatio Sprinkler

OFFICES IN PRINCIPAL CITIES OF NORTH AND SOUTH AMERICA

New Products, cont. . .

426 deg. F., and an iodine number of 169. It is insoluble in water, and miscible in all proportions with nearly all the common organic solvents.

Derivatives of dicyclopentenyl alcohol, such as dicyclopentenyl linoleate and allyl dicyclopentenyl maleate, have interesting air-drying and polymerizing properties, indicating potential uses in the coatings field. In general, the dicyclopentenyl group contributes toughness and hardness with an improvement in water and alkali resistance.

Other derivatives of dicyclopentenyl alcohol which might be interesting as raw materials for coating vehicles include di-(dicyclopentenyl) adipate or maleate, and vinyl dicyclopentenyl other.

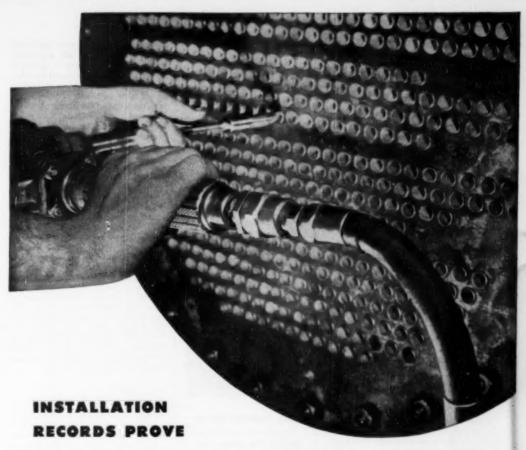
Dicyclopentenyl acrylate and methacrylate are monomers that copolymerize with a wide variety of other monomeric materials and impart airdrying or heat-curing properties to the copolymers.

In addition to the preparation of esters and a vinyl ether, dicyclopentenyl alcohol may be oxidized to a ketone, hydrogenated to the saturated alcohol, dimerized to a C_{∞} alcohol, and made to undergo all the normal reactions of a secondary alcohol such as oxidation to a ketone, cyanoethylation, reaction with ethylene oxide, and formation of acetals. Chlorine may be added to the double bond and the hydroxyl converted to a chloride.

Dicyclopentent linoleate polymerizes to an insoluble coating when airdied or baked in the presence of metallic driers. Preliminary tests on this material were done with 0.05 percent cobalt, 0.03 percent manganese and 0.05 percent lead. Films were applied over tin and black plate at 3 mm. Baking schedules were 1 hr. and 2 hr. at 300 deg. C. The baked material was nailproof at both schedules, and had somewhat the film characteristics of a coating from a baked unbodied oil. For such a low viscosity material, however, it was unusual in showing little tendency to gather, pit or crawl during the baking. Resistance to boiling water for 30 min. was good. The films failed in less than an hour when immersed in xylol.

Air-dried films were similar to those of linseed oil although, in general, they showed better hardness.

One of the most interesting potential uses for dicyclopentenyl linoleate is as a thermosetting plasticizer for the more unusual types of coating resins utilizing vinyl type polymerization. Typical of these are diallyl (Continued)



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Actually, you want the kind of efficiency that provides smooth operation, lasting quality, and low maintenance. Then, power consumption has a true relationship to overall pump performance — and that's what pays off on the cost sheet. Morris slurry pump efficiency ratings are the kind you can depend upon . . . they result from studies of hundreds of case histories of Morris slurry pumps in all types of solids handling service.

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New PRODUCTS, cont. . .

maleate and unsaturated polyesters prepared from glycols and maleic anhydride with or without a saturated dibasic acid. Dicyclopentenyl linoleate is completely compatible with materials of this sort and copolymerizes with them during the curing operation. Films of such mixtures have good adhesion, toughness and gloss and, in many cases, outstanding resistance to water, caustic and strong solvents. In mixtures such as these, conventional metallic driers should be omitted; peroxides may be used instead.

Allyl dicyclopentenyl maleate is another interesting film-forming material. It can be "bodied" to a high viscosity with peroxide catalysts, and air-dried or baked films have good hardness and toughness. Allyl dicyclopentenyl maleate is miscible with drying oils and a 1:1 mixture with linseed oil baked 1.5 hr. at 150 deg. C. gave a pale, hard, tough, adherent, marproof coating on metal. Flexibility can be improved by coreaction of the allyl dicyclopentenyl maleate with a diethylene glycol maleate polyester.

Samples and technical data can be obtained from the producer.—Rohm & Haas Co., Washington Square, Philadelphia 5, Pa.

Amine Type: Accelerator Activator

(174A) Aktone, a new amine type accelerator activator designed for use with thiazole and thiuram primary accelerators, produces maximum increase in activity and minimum scorchiness at substantial cost savings. Developed in the research laboratories of the J. M. Huber Corp., Aktone effectively activates MBT and MBTS both in natural rubber and GR-S with little or no increase in scorchiness.

More active in GR-S, Aktone helps to reach an equal state of cure in both hydrocarbons in blends of natural rubber and GR-S. In natural rubber, Aktone is very effective in gum stocks and those with clay and furnace black

For GR-S and cold rubber camelback compounds, a combination of equal parts of Aktone and MBTS has proved to provide good acceleration. This combination substantially reduces the tendency to set up in storage and maintains curing rate after long storage periods. Aktone can be obtained in both flake and powder form; specific gravity of the flake is 1.32, while the specific gravity of the powder form is 1.50. Both forms of Aktone are white and have a 90 deg. C. softening point. At high humidity Aktone is (Continued).

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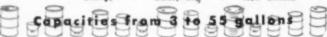


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NEW PRODUCTS, cont . . .

hygroscopic. It has been used in cold rubber and natural rubber formula-tions, as well as in blends of natural rubber and cold rubber, natural rubber and GR-S, and cold rubber and

Aktone is shipped in 50- and 80-lb. multiwall paper bags.—J. M. Huber Corp., 342 Madison Ave., New York 17, N. Y.

ESTER TYPE: Brush Killers

Chemical brush killers containing new type ester formulations are effective on a wider variety of brush and weeds than previous formulations. What's more, these chemicals, now to be had from Dow Chemical Co., are less volatile than materials previously offered.

The acid equivalent content of two roducts, Esteron Brush Killer and Esteron 245, has been increased from 3.34 to 4 lb. per gal. Both products have an improved range and effectiveness of control, according to Dow, and

at no increase in price.

These improved brush killers are formulated with esters of low volatility. Esteron 245 contains propylene glycol butyl ether ester of 2,4,5-T. Esteron Brush Killer contains 50 percent of this ester and 50 percent of the same ester of 2,4-D.

Dow points out that while the new formulations are less volatile, the user should exercise care in their application, especially in the control of spray drift.-Dow Chemical Co., Midland, Mich.

FOR HIGH VACUUM: Pump Fluid

National Research Corp. now has in stock ready for sale Narcoil-20, its new diffusion pump fluid. This is di-2-ethylhexyl sebacate specially treated for high-vacuum use.

With this new ester, pressures as low as or lower than those obtainable with any other pump fluid can be attained. National Research recommends the fluid for its own line of standard purifying type oil diffusion pumps. oil is also recommended for use in any diffusion pump for service where pressures of less than 0.1 micron are re-

The fluid is available in pint, quart and gallon containers for laboratory to plant-scale applications. It should be of particular interest to large users of diffusion pump oil, such as manufacturers of cathode-ray tubes.—National Research Corp., 70 Memorial Drive, Cambridge, Mass.

-End

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steam motor car to reduce the boiler pressure from 800 psi to 100 psi for the operation of a turbo generator for driving the fuel oil burner and furbo generator for driving the fuel oil burner and blower. It operates by means of a pressure operated relay valvo when the vehicle is not running, every time that the fire under the boiler goes on and also floats a storage battery on the line. I like the CASH STANDARD '1000' reducing valve because it is SIMPLE IN CONSTRUCTION, LIGHT IN WEIGHT, AND REQUIRES PRACTICALLY NO MAINTENANCE."

-from an engineer

"The CASH STANDARD '1000' Valves that w have in this plant are proving most SATISFAC-TORY IN ALL RESPECTS."

-from a manufacturer

"Most of our Type '1000' Valves have been in service for about 4 years and HAVE NOT RE-QUIRED ANY ATTENTION in that time except to adjust for different pressure requirements -from a manufacturer

"The CASH STANDARD 1000" Valves that we have in use have given us ABSOLUTELY NO TROUBLE and are preferred by our engineers to anything else on the market."

-trom a vice president

"The ELIMINATION OF STEAM LEAKS and LOW MAINTENANCE COST have been especially gratifying. The LOW INITIAL COST, LOW MAINTENANCE, and TROUBLE FREE OPERA-TION results in the MOST ECONOMICAL PRES-SURE REDUCING VALVE we have been able to purchase.

-from an instrument engineer

WRITE FOR BULLETIN 962

A. W. CASH COMPANY DECATUR, ILLINOIS

BULLETINS AVAILABLE ON OTHER CASH STANDARD VALVES Send for them



Bullatin 950-Indures the CASE STANDARD Type D Single Sect Free sure Reducing and Regulating Valve for use with most fluids. Short simple inner working parts that ser how volve works. Blueprint ske

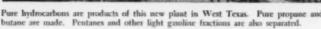


STANDARD Type 4030 Bock Pressure Valve - designed to autometically evaporator corresponding to a con-stant temperature desired. Shows an Ammonia and Franc Gas Capacity Chart based on ABSOLUTE pressures.



STANDARD Self-Contained, Pilet Operated Type 10 Pressure Reducing and Regulating Valve for one with water or oir; with any gas or oil that is non-corrective, and with refrigerat-ing fluids such as Ammania and Frann, Many interesting particulars explained such as how valve works, tight seating, lorge casecity, no waste, no water frammer or chaffer.







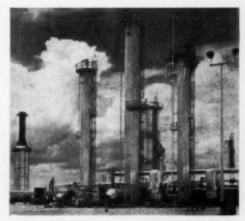
Hydrocarbons From Natural Gas

This new Sid Richardson gasoline plant near Kermit, Tex., is designed to recover 75 percent of the propane in the raw natural gas and 98 percent of the butane and heavier homologs contained in the feed-gas. At appropriate points in the system, ethane-rich fractions are also available for further processing. Pentanes and other light gasoline fractions are also separated, ready for further processing as needed.

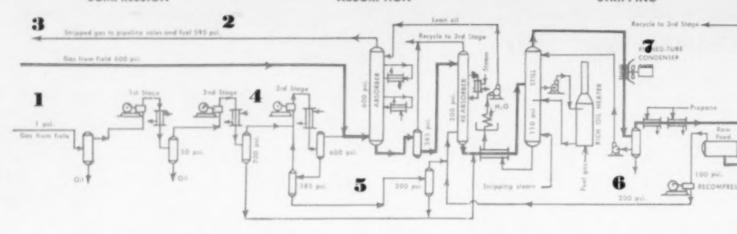
The plant takes gas from the Keystone field at 600 psi. and lower pressures. Low-pressure gas is compressed to 600 psi. and mixed with the high pressure feed gas where it enters the absorbers. Then countercurrent absorber oil strips the gas, which is delivered to the pipeline customer. Rich-oil is taken from bottom of absorbers, methane is removed, compressed and returned to gas line. Ethane is eliminated by an re-absorber and rich-oil is passed to a still. Next the overhead fraction of the still is fed to a fractionating section where a series of columns separate residual ethane and then take out butane and propane. The separated streams of propane, butane and grade gasoline are each passed to treating units to remove hydrogen sulphide and partially remove the mercaptans by means of caustic washing. Finally the products are treated with cuprous chloride to convert remaining mercaptans into non-corrosive disulphides. The caustic used in the treatment is regenerated and the mercaptans are recovered in the regeneration process.

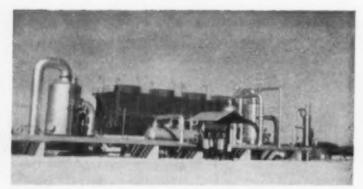
JULY 1950 · CHEMICAL ENGINEERING · PAGES 178-181

FOR MORE DETAILS see the plant description article by H. H. Jones and J. T. Cox, Jr., on pages 110-112. They have prepared a comprehensive explanation of this modern natural gas processing unit.



This plant recovers 75 percent of the propone and 98 percent of butane and heavier homologs from the gas.





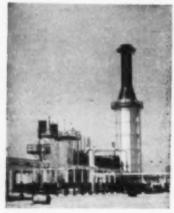
Scrubbers are used to remove mechanical debris and entrained water from the raw feed gas as it enters the plant from the Keystone natural gas field.



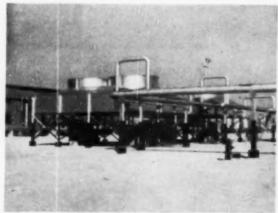
Pressure control station is used in the line carrying gas out of the plant after it has been stripped of propune, butane and heavier hydrocarbons.



Absorbers and still for primary stripping are shown from left to right.



Rich oil heater is used to heat part of the oil to 500 deg. F.



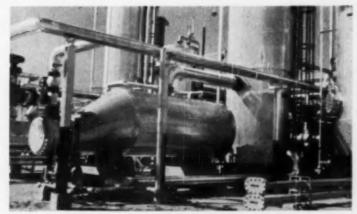
Finned-tube condensers are used to precool the overhead vapor which comes from the stripping still. Ethane removal is next.



Desulphurizing unit takes the stripped gas from the absorbers. Here hydogen sulphide is removed by means of ethanolamine treatment.



1 Compressors are a vital part of this plant's operation. Here are the high pressure and low pressure cylinders with receivers in the compressor house.



as been

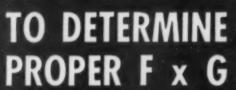
Fractionation units use aluminum sheathing for utility and beauty. Also shown here in the foreground is a typical reboiler used in the Kermit, Tex., unit.



After ethane is separated butame and propose are cut out.



10, 11 Then propose and butane are separated in still.



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ILLUSTRATION SHOWS HYDRAULIC DRIVING UNIT WITH COVER REMOVED

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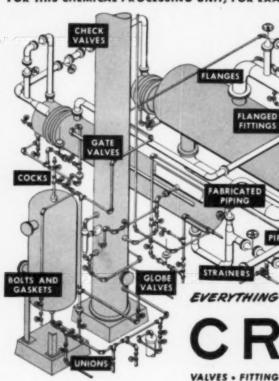
That's what you get with Crane Monel-Trimme Globe Valves. Unusually sturdy and rugged, the features for safe control of highly toxic and cor

For example, note the specially designed, exbox. It's equipped with a packing spacer and for proper lubrication of upper and lower pacthe heavy cast steel body section... the busky Crane male and female bonnet joint design minleakage or blowout.

From end to end, these valves offer outstandin Threads in screwed end valves are extra lon valves have large, raised male faces, finished grooves. See your No. 49 Crane Catalog, or AD-1622-A.

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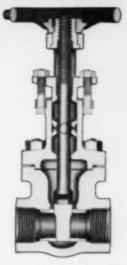
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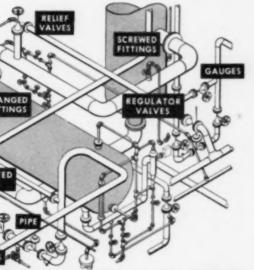
tanding safety features. ra long. Flanged end nished with concentric og, or send for folder

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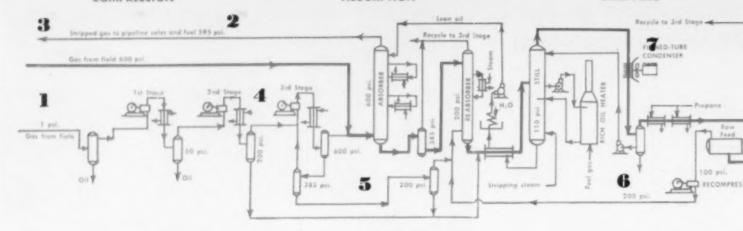


Diagram showing Screen Mill and Mechanical Air power consumption. Write for bulletin No. 39B. Separator in closed circuit for producing high fineness finished materials. Raymond Equipment includes Fine Grinding Units with Capacities up to 30 Tons or more per hour.

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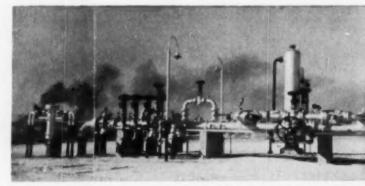
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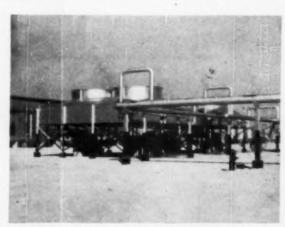
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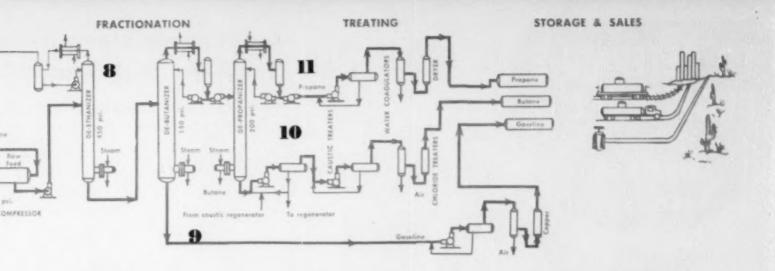
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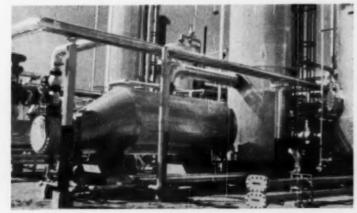




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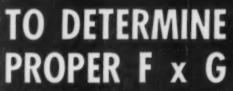
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ILLUSTRATION
SHOWS HYDRAULIC
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- * Basket speed indicator is standard equipment
- * Case can be jacketed for circulating steam or coolant
- * Can be furnished completely fume tight, as illustrated
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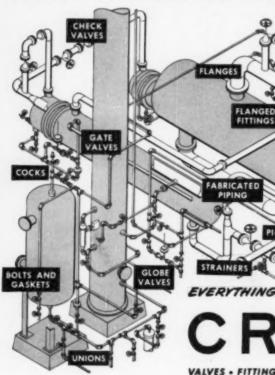
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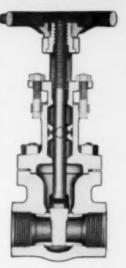
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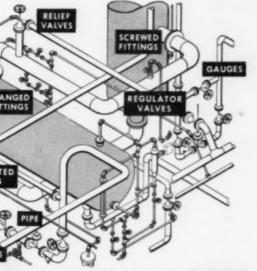
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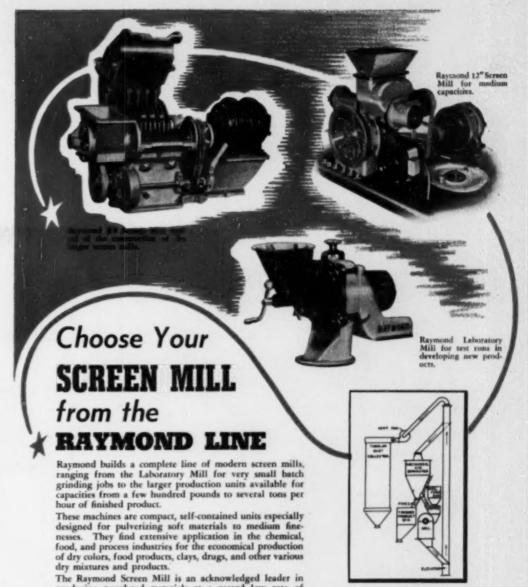
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Diagram showing Screen Mill and Mechanical Air Separator in closed circuit for producing high fineness finished materials.



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July 1950-CHEMICAL ENGINEERING

Chemical Engineering News

JOSEPH A. O'CONNOR, News Editor



Big Solvent De-Waxing Plant to Produce 178 Million Pounds of Wax a Year for Esso

A modern solvents de-waxing plant, which replaces with a continuous and automatic process the traditional manual wax-making operation, has been put on stream at the Bayonne refinery of Esso Standard Oil Co.

This new de-waxing unit, which is an MEK plant, will produce 178 million pounds of wax annually. It completes the latest general modernization of the 75-year old plant, the oldest in the Esso company and a specialty plant producing wax, lubricating oils and explait.

ing oils and asphalt.

The modernization program includes the installation of a new boiler house and two new boilers capable of producing 400,000 lb. of steam per hour. Representing one of the most vital utilities in oil refining, output of the boilers would be sufficient to heat all the homes in the city of Bayonne.

Eliminating a process of wax-making that goes back to the earliest days of oil refining, the new plant will permit Bayonne to maintain its position as one of the foremost wax-producing refineries. In the past, wax was separated from chilled oil in plate and frame presses. Solidified wax was

zetained on canvas cloth filters and the wax cake removed by hand scrapers. De-waxed oil flowed beneath the press and was processed into lubricating oils.

In the modern operation, a waxy feed stock is mixed with a solvent composed of methyl ethyl ketone, benzene and toluene. This lowers the viscosity of the oil feed and accelerates the separation of wax from the oil. Rotary filters effect the actual separation.

MCA Plans to Intensify Its Program of Activities

Plans for greatly expanded, more aggressive trade association activities in the chemical manufacturing industries got top attention from 350 executives and other business leaders during two days of meetings at Spring Lake, N. J., in mid-June. The occasion was the 78th annual meeting of the Manufacturing Chemists Association and its joint outing and banquet with the Synthetic Organic Chemical Manufacturers Association.

First step toward a united industry was the overwhelmingly favorable

vote for the consolidation of the Plastics Materials Manufacturers Association, Inc., with the Manufacturing Chemists Association, Inc. The PMMA, holding its annual meeting simultaneously in Massachusetts, quickly ratified the merger plans and its activities will shortly be integrated into those of the older Association. So far no progress has been reported on the proposed MCA-SOCMA merger, although both groups have liaison committees studying such a plan.

George W. Merek, in his presidential address, launched a broader program of public relations and related educational activities. He stressed the industry's urgent need for increased public awareness of its efforts and achievements in preventing air and stream pollution, improving its already excellent safety records and otherwise contributing to health and happiness. He presided at a panel discussion arranged by J. Handly Wright of Monsanto, chairman of the MCA Public Relations Committee. George R. Freyermuth of Standard Oil Company (N. J.) and chairman of the Oil Industry Information Committee of API, Glen Perry of the DuPont Company, and S. D. Kirkpatrick of McGraw-Hill outlined steps to be taken in organizing an adequate educational program. Appointment of Robert L. Taylor (see article and photo) to the newly created post of executive vice president was hailed as a significant step in this direction. Located in New York, he will work with Secretary Maurice F. Crass, Jr., in Washington and other officers in organizing and presenting MCA's work and objectives to its membership and to the public at

William M. Rand, chairman of MCA's Board of Directors, introduced Howard Huston of American Cyanamid and Sidney C. Moody of Calco. The former had just returned from Geneva and reported on the recent activities there of the International Labor Office. Moody, as president of SOCMA, told of the important tariff problems facing the industry, particularly in the possible loss of the American evaluation basis for determining import duties.

(Continued)



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News, cont. . .

Admiral Lewis L. Strauss, former member of the Atomic Energy Commission and president of the Institute of Advanced Studies at Princeton, N. J., urged better understanding of "atomic facts and fallacies" by industry. Major General Anthony C. McAuliffe, chief of the Chemical Corps, asked for continued teamwork, pointing out that anything that affects chemical industry has a vital relation to the national defense.

His Vinyl Dispersion Resins Win Hyatt Award for Powell

The John Wesley Hyatt Award for distinguished achievement in plastics has been presented to George M. Powell, III, technical head, Vinyl Coatings Research, Union Carbide & Carbon Corp., South Charleston, W. Va.

The Honorable John W. Snyder, Secretary of the Treasury, gave the presentation address.

Waldemar Kacmpffert, science editor, New York Times, and a member of the John Wesley Hyatt Award Committee, made the award, a gold medal and \$1,000 in cash, at a banquet at the Hotel Pierre in New York. A group representing the merchandising, banking, plastics and chemicals fields attended the ceremony.

The award was presented to Powell

for his work in planning and directing the development, formulation and application of Vinylite dispersion resins. He was primarily responsible for the development of a method that makes possible the use of high polymers in high solids dispersions in combination with inexpensive thinners.

Charles A. Higgins, president of Hercules Powder Co., in a short talk described the rapid growth of the plastics industry, and also the contribution of small business to that growth.

Dean Richard F. Bach, Metropolitan Museum of Art in New York, served as toastmaster.

Powell's work enabled the plastics industry to enter the manufacture of products never before practical with materials usually associated with this industry. The toughest and least soluble of the vinyl resins can be used economically to coat cloth, paper, foil and metal, and also for inks, dip goods, clastomeric molded articles and unsupported films.

Vinyl dispersion resins are vinvl chloride acetate resins having a high chloride content. These resins have one important unique characteristic. Their sub-microscopic size makes it possible to disperse them in liquids and to obtain a high percentage of solids content. These extremely small particles then gather into a mass in which they are arranged in such a way

(Continued)



HYATT AWARD TO CARBIDE'S POWELL FOR WORK ON VINYLS

The Honorable John W. Snyder, Secretary of the Treasury, center, and Charles A.
Higgins, right, president of Hercules Powder Co., which is the patron of the award,
congratulate George M. Powell, III, winner of the ninth John Wesley Hyatt Award
for distinguished achievement in plastics. Presentation took place in New York at
banquet in Hotel Pierre. Powell, who heads vinyl coatings research for Union
Carbide & Carbon Corp., was honored for his work on vinyl dispersion resins. He
developed a method that makes possible the use of high polymers in high solids dispersions in combination with inexpensive thinners.

TO RESIST HIGH and H.SO. FUMES

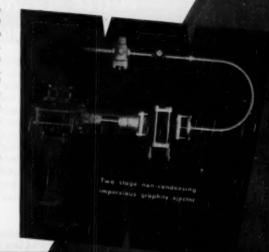
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News, cont. . .

that they can be redispersed in either volatile or non-volatile liquids. After the dispersed particles are applied to the wire, sheet, glove, or whatever is to be treated, the resin is dissolved and fused into a continuous film by heating it.

The rapidity with which the dispersion resins have been adopted by industry is a measure of their worth. Although development work on them began in 1934, the material was not ready to be offered to industry until 1943, nine years later. By 1947, consumption had grown to 5 million pounds. Two years later the major (Continued)

CONVENTION CALENDAR

- Third Western Packaging Exposition, San Francisco Civic Auditorium, San Francisco, August 14-16,
- National Association of Power Engineers, National Power Show, Hotel Jefferson, St. Louis, Mo., August 14-18.
- Metal Mining Convention and Exposition, Fairgrounds, Salt Lake City, August 28-31
- American Chemical Society, 118th national meeting, Chicago, September 3-8.
- National Chemical Exposition, Coliscum, Chicago, September 5-9.
- American Institute of Chemical Engineers, regional meeting, Radisson Hotel, Min-neapolis, Minn., September 10-13.
- American Society of Mechanical Engineers and Instrument Society of America, Municipal Anditorium, Buffalo, N. Y., September 11-15.
- Synthetic Organic Chemical Manufacturers Association, Commodore Hotel, New York, September 13.
- National Petroleum Association, Hotel Traymore, Atlantic City, September 13-15.
- Instrument Conference and Exhibit, Instrument Society of America, Memorial Auditorium, Buffalo, N. Y., September
- Drug, Chemical & Allied Trades Section, New York Board of Trade, annual meeting, Shawnee Inn, Shawnee-on-Delaware, Pa., September 21-23.
- American Society of Mechanical Engineers, Petroleum Mechanical Engineering Conference, Roosevelt Hotel, New Orleans, September 25-27.
- American Oil Chemists' Society, fall meeting, Sir Francis Drake Hotel, San Francisco, September 26-28,
- American Coke & Chemicals Institute, Skytop Lodge, Skytop, Pa., September
- American Association of Textile Chemists & Colorists, The Wentworth, Portsmouth, N. H., September 28-30.

10,000 DROP

and not lose a cent

If you shipped riboflavin—a widely used vitamin—the very, thought of somebody dropping one of your shipping drums would give you gray hairs. A single drum of riboflavin is worth upwards of \$10,000. But one of Continental's regular line of shipping drums—the Leverpak drum—is the choice of many companies for safeguarding their most valuable products.

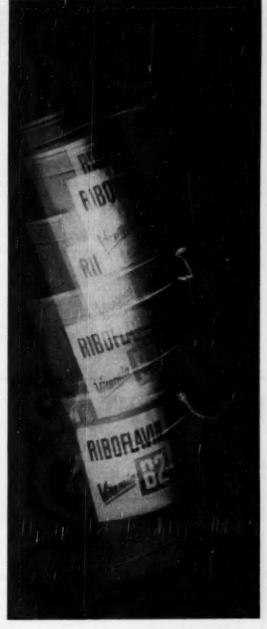
The stroboscopic photograph at the right shows a Leverpak drum containing four hundred pounds dropping four feet. It didn't leak, shatter or fracture. Not a penny's worth of the contents will be lost!

This Leverpak drum is just one example of Continental's ability to develop packages to meet exacting requirements. Like all Continental drums, it is light in weight to save shipping costs, and can be furnished in a wide variety of linings and coatings.

Whatever your product, Continental can supply you with a package that will stand up in service, stand out in appearance. Continental is famous for its fine lithography and decorative work. Drum, can, or paper container—if you have a packaging problem, our technical staff is

ready to help you solve it. Continental is big enough and flexible enough to handle any packaging situation.

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production processes for finished articles had been perfected, and consumption more than tripled that of 1947.

Powell was born in Montgomery, Ala. After graduating from high school in Leonia, N. J., he entered Columbia College in 1927, receiving the A. B. degree in 1931. He then transferred to the School of Chemical Engineering, receiving the B. S. in chemical engineering in 1932, and the Ch. E. degree in 1933.

In that year also he joined Carbide & Carbon Chemicals Corp., and immediately engaged in research on surface coatings. He was made technical head of the Coatings Division of the Research and Development Depart-

ment in 1944.

Powell is the recipient of the ninth ohn Wesley Hyatt Award, of which Hercules Powder Co. is the patron. The award was named to commemotate John Wesley Hyatt, "the father of the plastics industry." It was Hyatt's work with cellulose nitrate and camphor, in 1867, which resulted in the making of the first thermoplastic. celluloid.

The award has been presented anhually since 1941 to the person judged by the Hvatt Award Committee to have made an outstanding contribution to the plastics industry during the preceding year.

The conditions which govern the selection of medalists are: the practicability of the achievement, its effect upon the plastics industry, its probable future value, and its degree of originality.

Members of the award committee are: Horace Gooch, Jr., president, Society of the Plastics Industry, Inc.; Dr. Charles F. Kettering, vice president, General Motors Corp.; Dr. Ernest Volwiler, president. American Chemical Society; Dr. Edward R. Weidlein, director, Mellon Institute of Industrial Research; Dean Bach; Dr. Felbeck, the 1948 medalist; and Kaempffert.

Kirkpatrick and Hochman Address Equipment Dealers

Dealers from all over the U.S. converged on New York last month for the meeting of the Process Equip-ment Dealers' Council held on Monday evening, June 12, at the Hotel Statler in that city. It was one of the best attended meetings of the year.

Chief speaker of the evening was Sidney D. Kirkpatrick, editorial director of Chemical Engineering and vice president of the McGraw-Hill Book Co. His topic was "The Used Machinery Dealer's Place in the Sun." Drawing upon his experiences as an advisor to government and private industry, Kirkpatrick cited the vital role played by used equipment during World War II and predicted limitless new vistas for the chemical industry. A question and answer period followed.

Ralph Hochman, former president of the National Machine Tool Dealers Association, discussed association problems that he had encountered during his wide experiences and told how they had been solved.

Presiding at the meeting was David M. Gold, executive secretary. The next dinner meeting of PEDC is scheduled for September.

Carbide Building New Unit To Make Polyethylene Resins

Bakelite Division, Union Carbide & Carbon Corp., announces plans for a new polyethylene resins plant at South Charleston, W. Va. The new plant is scheduled to be in full operation by the third quarter of 1951.

According to James W. McLaugh-lin, president of Bakelite, "These new (Continued)

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Parts for 444 Nicholson Steam Traps Installed in 2 Years

Here is added evidence of the remerkably low maintenance costs of Nicholson expansion

steam traps. In the 2 years Bradshow & Co. have been distributing them in the Pittsburgh area they have installed 444 traps. But they have recoived not one order for repair parts. And exemination of traps in continuous drainage service for at least 18 months, at steam pressures to 250 lbs., showed no sign of valve cutting.

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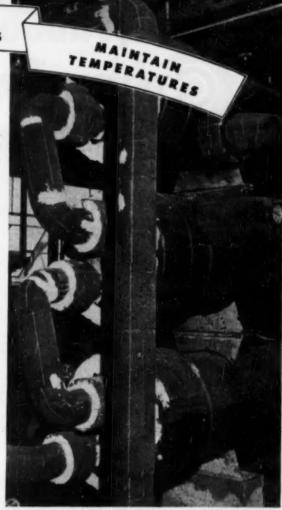
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The cellular glass structure of Foamglas makes it an exceptionally effective insulation. And, being glass, it has unusually high resistance to moisture, vapor, acid atmospheres and other destructive elements. The resultant freedom from repairs, maintenance and replacement makes Foamglas a truly economical insulation. When properly installed, Foamglas retains its original insulating efficiency.

You can get PC Foamglas Pipe Insulation in a wide range of standard sizes for indoor and outdoor piping. Covers of Foamglas for elbows, valves and other fittings can be procured from the factory, or quickly and easily fabricated in the field. For insulating tanks, towers and other vessels there are standard flat blocks of Foamglas, beveled lags and special shapes. Curved segments for heads and domes also can be obtained.

When you are figuring on insulation, make sure you have the latest information on PC Foamglas. You will find it in our newly published booklet, which contains descriptive text and photos of recent jobs, charts, tables, up-to-date specifications and installation instructions. Just send in the convenient coupon and you will receive promptly a sample of Foamglas and your free copy of the booklet.



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News, cont. . .

facilities will almost double the present production rate of Bakelite polyethylene and will help relieve the shortage of this versatile material."

The new plant, which will produce the basic resins from which the polyethylene plastics are made, is being constructed and will be operated by Carbide & Carbon Chemicals Division, Union Carbide & Carbon Corp.

"In the packaging field, polyethylene, flexible, non-breakable bottles, vials, and similar containers have found increased usage," McLaughlin points out. "Polyethylene bottles are currently being produced at a rate in excess of 65 million per year," he adds, "and it is expected that this production will be at least doubled by the end of 1950."

Economical methods have been developed for producing thin film from polyethylene by extrusion. The inert nature of the material, being non-toxic, tasteless, odorless, and possessing low moisture vapor transmission and excellent low temperature flexibility, makes it important in the packaging of foods. The film is also used for packaging small metal parts, soaps and chemicals.

GE Spending \$1 Million On Taunton Plastics Unit

General Electric Co. is about to launch a \$1 million improvement program to make the Taunton, Mass., plant of its Plastics Division one of the largest plastics operations in the country.

Plans are being made to alter nearly all interior sections of the Taunton plant and to modernize equipment for maximum production efficiency. Presses with the newest and fastest controls now known to the plastics industry will be added. Scheduled for completion about the end of 1950, these extensive alterations will begin this month.

The decision to expand and modernize the Taunton plant came at the close of a comprehensive study of the best means of speeding the growth of the GE plastics business. That location was selected because it has been producing both thermosetting and thermoplastic parts.

Manufacture of all molds used in plastics production at Taunton, Mass., and Decatur, III., will be consolidated in a larger and improved tool room at Pittsfield, Mass. The transfer of molding equipment to Taunton will also make room at Pittsfield for the eventual expansion of several chemical manufacturing activities. More

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can be used in steam, water, oil, gas or chemical service.

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NEWS, cont . . .

room may be needed there for molding silicone rubber, producing magnesium oxide, and for manufacturing plastic resins and compounds.



Robert L. Taylor

Taylor Gets New MCA Post Of Executive Vice President

Robert L. Taylor has been appointed to the newly created office of executive vice president of the Manufacturing Chemists' Association, Inc., it was announced by MCA President George W. Merck at the organiza-tion's 78th annual meeting held at Spring Lake, N. J., last month.

Taylor has been editor of Chemical Industries, a magazine published by Maclean-Hunter Publishing Corp. since 1943. He will take up his new duties Oct. 1.

Merck said Taylor will establish headquarters offices in New York later in the year. The present offices in Washington, D. C., will be maintained under the direction of Maurice F. Crass, Jr., secretary.

For the past 14 years Taylor has been engaged in publication and public relations work in the chemical industry. Following graduation in chemical engineering from the University of Michigan in 1936, he joined the editorial staff of Chemical & Metallurgical Engineering. After leaving this magazine two years later, he served as assistant to the director of advertising and public relations of Monsanto Chemical Co. He became editor of Chemical Industries in 1943.

He is a past chairman of the New York section and the public relations committee of the American Institute of Chemical Engineers, a founder and first president of the Junior Chemical Engineers of New York, immediate (Continued)

July 1950-CHEMICAL ENGINEERING

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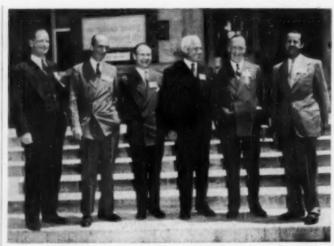
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FAMED SCIENTISTS HELP DEDICATE NATIONAL DAIRY'S NEW LABS President Lauren B, Hitchcock (far left) of National Duiry Research Laboratories and President L. A. Van Bomel of National Duiry Products Corp. (second from right) were ably assisted June 2 in dedicating the corporation's vast new research laboratories at Oukdale, L. I., by this panel of noted scientists and authors: Dr. Janoratories at Oaksaie, L. 1., by this panel of noted scientists and authors: Dr. Fairfield Osborn, president of Conservation Foundation and author of "This Plundered Plant" (second from left); Dr. Charles Glen King, scientific director, Nutrition Foundation; Dr. Karl T. Compton, chairman, Massachusetts Institute of Technology; and, at far right, Dr. W. Rupert MacLaurin, professor of economics, MTT. MIT, and conference moderator. Not shown but also participating prominently in this conference on world food and nutrition problems was Louis Bromfield, famous farmer, author and conservationist.

News, cont. . .

past president of the New York Business Paper Editors, and member of the American Chemical Society, American Institute of Chemists, Society of the Chemical Industry, Chemists' Club and Tau Beta Pi. He attended the atomic bomb tests at Bikini in 1946 as a representative of the technical press.

Koppers to Build Coke Ovens For Carnegie-Illinois Plant

Construction of two new coke battenes of 87 ovens each at Clairton Works of U.S. Steel's Carnegie-Illinois Steel Corp., replacing two batteries of old ovens, has been scheduled. Contract for the work has been awarded Koppers Co., Inc.

Actual construction of the first new battery is expected to get under way early in September, with work on the second starting about 60 days later. The batteries are scheduled to go into operation about one year after the start of construction work.

The new byproduct ovens will be of the underjet type, designed for coke-oven gas heating, with re-circulation of waste gases. The batteries will carbonize 5,000 tons of coal every

24 hr., yielding approximately 3,300 tons of coke in the same period.

Clairton Works contains 1,567 ovens which recover chemicals and gas during the coking of coal.

Chrome Yellow Production Starts at Willow Island

Medium chrome yellow pigment is now being manufactured by the Calco Chemical Division of American Cyanamid Co. in the recently constructed plant for its production of Calco's big Willow Island, W. Va., works.

This pigment was formerly made at the company's Newark, N. J., plant. In transferring operations to the Willow Island location, the process was modernized to embody the latest techniques in high-efficiency continuous operation. Construction was handled by Wilson Bros., a Parkersburg, W. Va., contracting firm. But all engi-

neering work was done at Calco's Bound Brook, N. J., plant. The chrome yellow plant consti-tutes the third unit of the Willow Island inorganic pigment group. The unit for the manufacture of iron blue was started in February 1948, and a second unit for the production of chrome green was added in October

(Continued)

3 steps to successful

ION EXCHANGE PERFORMANCE

Whether it is a simple greensand softener or a large demineralizing plant, these three essential steps are necessary to produce an ion exchange installation which:

- · is easy to operate
- requires low chemical regenerating costs
- yields uniformly dependable performance



LABORATORY RESEARCH

Graver chemists and technologists are continually evaluating the performance of many ion exchangers to determine the optimum operating conditions for each. As a result of this work the specific advantages of more than forty available Graver ion exchangers can be effectively applied to a wide range of processes.



PILOT PLANT OPERATION

Graver development engineers regularly conduct tests on small scale pilot units operating under simulated plant conditions. These tests serve to check laboratory experiments and to work out problems in mechanical design. This assures dependable operation of the ion exchange equipment under actual service.



COMMERCIAL EXPERIENCE

A background of thirty years' successful commercial experience is reflected in the design of Graver equipment. Graver chemical engineers have pioneered the commercial application of many new ion exchange processes. Dependable service is assured as a result of this experience.



"Operating experience with Resin Zealites on the Hydrogen Cycle"

"Present Practices in the Use of lan Exchangers in Water Treatment"

"Silica Removal by a Practical Ion Exchange Process"



GRAVER WATER CONDITIONING CO.

216 West 14th Street, New York 11, New York, U.S.A.

A DIVISION OF GRAVER TANK & MPG. CO. INC. EAST CHICAGO, IND.



the BOTTLE gets a break

Beverage bottles get rough use; breakage is high in handling. Close packing in the cooling lehr during manufacture causes bottles to rub together; appearance is marred, bursting strength greatly reduced.

A "Virginia" technique of introducing small quantities of liquid sulfur dioxide (SO₂) into these lehrs as a reducing agent puts a protective lubricating coat on each bottle. This eliminates most of the scratching and increases the bursting strength of the bottles up to 40 percent. Substantial savings can be effected by using thinner glass.

For 29 years, "Virginia" has been developing new methods, short cuts, and economies in the industrial application of its high-quality, inexpensive

VIRGINIA

SO₁. More than 40 different industries are now benefiting from this vast accumulation of experience. "Virginia" chemists know how to translate the varied SO₄ properties as a reducing, neutralizing, and bleaching agent, preservative, antichlor, and pH control into concrete industrial advantages.

"Virginia" is the world's largest producer of SO₂. Take advantage of "Virginia's" free, comprehensive technical service—discover how "Virginia" Liquid SO₂ may lower your costs and improve your products or processes. Send for our SO₂ folder. VIRGINIA SMELTING COMPANY, Dept. 21, West Norfolk, Virginia.

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VIRGINIA.

(hemicals)

News, cont. . .

1949. Facilities have been planned and space provided for further enlargement and expansion of capacity for this line of pigments. This large installation makes the Willow Island plant one of the principal sources of these inorganic pigments in the U. S.

Chrome yellow pigments are used in house and industrial paints, inks for magazine and carton printing, coloring crayons, paper and linoleum. In addition to dyes and pigments,

In addition to dyes and pigments, Willow Island produces folic acid, an important synthetic vitamin identical with the natural vitamin from liver; melamine resins for the textile, plastics and paper industries; and textile brighteners for use in soaps and detergents.

Tator Names Pierce to Head New Corrosion Subcommittee

The Technical Practice Committee of the National Association of Corrosion Engineers, in its recent meeting at St. Louis, created a subcommittee of Technical Practice Committee No. 6 on Protective Coatings to work on problems of corrosion protection by the use of chemical-resistant masonry constructions.

Kenneth Tator of Kenneth Tator Associates, Coraopolis, Pa., chairman of TP6, has designated this subcommittee as Technical Practice Committee No. 6K—Chemical Resistant Masonry Construction, and has appointed Robert R. Pierce, product supervisor of the Pennsylvania Salt Manufacturing Co., Philadelphia, as chairman.

Rand of Monsanto to Get Chemical Industry Medal

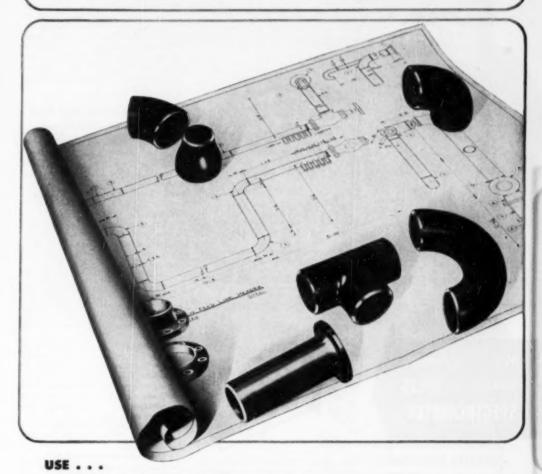
William M. Rand, president of Monsanto Chemical Co., St. Louis, Mo., has been chosen to receive the Chemical Industry Medal for 1950, according to an announcement by the American Section of the Society of Chemical Industry, donor of the medal. The medal will be formally presented to Rand at a meeting of the American Section following a dinner in his honor at the Starlight Roof of the Waldorf-Astoria, New York City, on Nov. 3, 1950.

The Chemical Industry Medal was

The Chemical Industry Medal was established in 1933 and is awarded annually in recognition of conspicuous services to applied chemistry. Rand, who is also president of the Manufacturing Chemistr' Association, was elected to receive the medal by the executive committee of the American

(Continued)

TO DO A BETTER PIPING JOB . . .

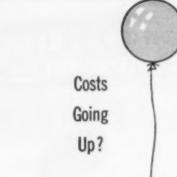


CLOBE PRECISION PROCESS SEAMLESS WELDING FITTINGS

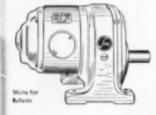
When you specify and use Globe Welding Fitings you have the product of an organization with unusually broad metallurgical experience. Globe's precision-process method of production reaches back to the manufacture of the Globe seamless tubes themselves which are the "raw material" of Globe welding fitting fabrication. GLOBE STEEL TUBES CO., Milwaukee 4, Wisconsin Chicago * Minneapolis * Cleveland * Detroil * New York * Philadelphia 5t. Louis * Tuisa * Houston * Denver * San Francisco * Glendole, Col.

Producers of Globe seamless stainless steel tubes — Gloweld welded stainless steel tubes — carbon — alloy — seamless steel tubes — Globeiron seamless high purity ingot iron tubes — Globe Welding Fittings.

Send for the Globe Welding Fittings Catalog—and look to Globe as a preferred source of supply,



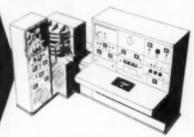
Pull them down with Sterling Sto-Speed electric power drives.



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SLO-SPEED (Geared) . SPEED-TROL (Variable Speed) . KLOSD (Normal Speed)

New ... Improved ANALYTICAL MASS SPECTROMETER



- GREATER SENSITIVITY
- GREATER FLEXIBILITY
- GREATER ACCURACY
- GREATER RANGE

The new Model 21-103 Analytical Mass Spectrometer, representing nearly three years of additional intensive research and development, retains the qualities and advantages of its predecessors — the Models 21-101 and 21-102—but provides

still greater flexibility, sensitivity, accuracy, range, and overall usefulness

This new mass spectrometer has been engineered to meet more fully the needs of the chemical industry. Its features, including the new ion source, the ISA-TRON, greatly enhance the use of mass spectrometry for purity determinations, and quantitative and qualitative analyses of mixtures of all types of gaseous and liquid compounds, including hydrocarbons, inorganic gases, and oxygenated and other substituted organic derivatives.

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CONSOLIDATED ENGINEERING

CORPORATION

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News, cont. . .

can Section of the Society of Chemical Industry sitting as the Committee

Dr. Gustavus J. Esselen, consulting chemist of Boston, and chairman of the American Section, will preside at the award meeting, and Dr. A. J. Weith, of the Bakelite Division of Union Carbide & Carbon Corp., New York, and immediate past chairman of the American Section, will present the medal. Rand will be the seventeenth recipient of the Chemical Industry Medal.

AEC Plans Pilot-Plant Trial For New Chemical Process

The U. S. Atomic Energy Commission has authorized construction of a \$500,000 pilot plant for chemical processing at the Wabash River Ordnance Works in Vermillion County, Ind. The announcement was made by Carroll L. Wilson, AEC general manager.

A small part of the space in the ordnance plant now is occupied by the commission, but the existing facilities have been in standby since 1945 and are outmoded and inefficient.

If the pilot plant process proves successful, the commission will modify the rest of the space or install new facilities at the ordnance plant. Renovation of these facilities and installation of new equipment are expected to cost about \$5 million.

Construction of these facilities, if undertaken, will begin this summer and will require 18 to 20 months to complete. It is estimated that the construction program will require about 800 men. Operation of the plant after completion, however, will call for less than 30 employees.

Girdler Corp. of Louisville, Ky., is completing studies on the feasibility of the process.

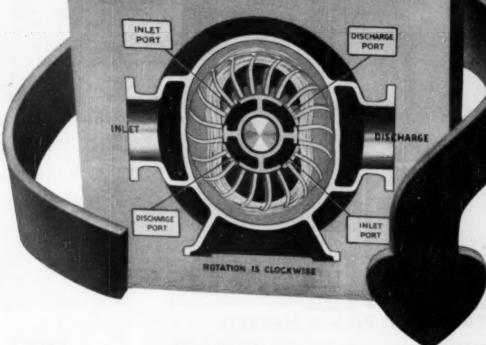
In making the announcement, Wilson stated that no radioactivity will be involved in the operations at the Wahash River Ordnance Works. The project, he added, is under the supervision of the New York operating office of the AEC. Further details of the project are not available now.

Florida Paper Mill Doubling Capacity at \$10 Million Cost

Hudson Pulp & Paper Corp. plans construction of a \$10 million addition to its plant at Palatka, Fla., it has been announced by Governor Fuller Warren and the corporation. Work on the addition is to start in the immediate future.

(Continued)

Nash Instrument Air Compressors deliver only clean air, free from oil or dust, and without filters



Here is Why!

You can dispense with oil filters and dust filters when you install "Nash" Clean Air Compressors. You can save the cost of maintaining these devices. You can greatly reduce instrument maintenance costs. For the Nash employs no internal lubrication, therefore no troublesome oil is in the delivered air. Moreover, air from a Nash is thoroughly washed and cooled as it passes thru the pump. Dust in the plant atmosphere, even fly ash, is immediately removed.

[®]Nash[®] Clean Air Compressors are simple, with only one moving element. No valves, gears, pistons, sliding vanes, or other enemies of long life and constant performance complicate a Nash. No aftercoolers are needed. You will find it profitable to investigate these pumps, now. No oil filters.

No dust filters.

No internal lubrication to contaminate air handled.

No internal wearing parts.

No valves, pistons, or vanes.

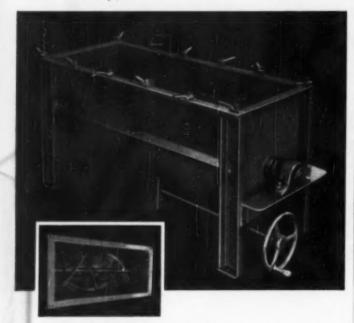
Non-pulsating pressure.

Original performance constant over a long pump life.

Low maintenance cost.

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AVOID UNMIXED VOLUME



Increase Mixing Efficiency and Cut Operating Costs with READ Spiral Ribbon Blenders



Any unmixed or dead volume found in a mixer after the mixing operation has been completed is costly. This can be eliminated with a Read Spiral Ribbon Blender.

In a Read Blender, the counter-flow action of the spiral ribbon agitator insures rapid, efficient mixing without material build-up at the ends. Ground fillets on the all-welded agitator prevents build up of masses during mixing. At the discharge point, a liquid-type flush plug discharge gate eliminates any build-up of dead material at this point.

Read Spiral Ribbon Blenders are built with batch capacities of from 1 to 500 cu. ft. Special units are custom-built for larger capacities. Models can be supplied for operation under pressure or full vacuum, and may be equipped with temperature controlling jackets. Structural steel legs can be supplied in various heights to suit operating conditions.

Write for complete information on the Read Spirol Ribbon Blender for your particular application.



READ MACHINERY DIVISION

of The Standard Stoker Company, Inc. YORK 1, PENNSYLVANIA News, cont. . .

William Mazer, executive vice president of Hudson Pulp & Paper, states that the expansion will double capacity of the Palatka plant and provide employment for 750 more persons, raise its annual payroll from \$2 million to \$4 million, and contribute another \$1.5 million to the state's economy through purchase of additional raw materials.

Last year the company produced about 63,000 tons of kraft paper.

Merck Takes Over Cherokee Ordnance Works from U. S.

Merck & Co., Inc., has concluded an agreement with the Department of the Army for a 15-year lease and eventual purchase of the governmentowned Cherokee Ordnance Plant near Danville, Pa.

Negotiations were completed when an Army representative signed the agreement in Washington, D. C. The company will use the plant to manufacture medicinal chemicals and fine chemicals for industry.

The Cherokee plant has been idle since the end of World War II and has been maintained by the government on a standby basis as part of the

preparedness program.

The Army-Merck agreement will relieve the government of the cost of maintaining the plant, which is believed to amount to about \$100,000 a year, while providing for quick reconversion to wartime uses in the event of a national emergency. Merck will assume the burden of maintenance and, in addition, will pay a yearly rental of \$30,000 for that portion of the plant that it plans to use.

Lease will expire Dec. 31, 1965. The company has an option to buy certain sections of the plant during that time and will purchase the remainder at the end of the period. The government will retain title to part of the plant while the lease is in effect, in case it again becomes necessary to use the facilities to produce war materials.

Merck expects to be able to start production at the Danville location next spring, and meanwhile will spend more than \$1 million to convert part of the facilities, install new equipment, and maintain the rest of the plant for the government.

Cherokee Ordnance Plant was built and operated for the government during the war by the Heyden Chemical Corp. It was used to produce chemicals for the war effort.

The property consists of 93 acres bying partly in the Borough of River-(Continued)

202

Eliminate Shutdowns Licensed by H. J. Hersey, J.

FOR DUST FILTER "Autoclean" CLEANING!

> The DAY "Autoclean" Dust Filter was designed primarily for chemical and other industries requiring continuous-automatic filtering with constant air volumes. Because of its automatic cleaning mechanism, the DAY "Autoclean" never has to be shut down for cleaning or rapping. This maintains uniform back pressure assuring a constant air volume through the entire filter at all times. The result is a continuous, effective and efficient job on even the finest dust particles.

DUST FILTER

Actual installations are operating successfully with air to cloth ratios of 10, 15 or 20 to 1. In many industries the highly effective performance of the DAY "Autoclean" results in the saving of valuable product.

Write For FREE Dust Filter Bulletin Number 491

Advantages OF THE DAY "Autoclean" DUST FILTE



A. Reverse air jet cleaning rings travel up and down the tubes of the DAY Filter constantly cleaning the cloth. This permits continuous filter operation with a maximum cloth area loss of only 114%

B. Most other types of filters must shut off a complete section for clean-ing or rapping. This may amount to 50% of the cloth area.

Parallel Air Flow-Dust laden air enters the

top plenum of the DAY "Autoclean" Dust Filter. Dust and air then travel together down the tubes. This parallel flow helps blow the dust into the bot-tom hopper. In opposed flow filters where the dust laden air enters at the bottom, the upward pressure of the air escaping through the cloth tends to hold the dust within the tube until the air is shut off.





A. Back pressure rises slightly when the DAY Filter is first started, then levels off and remains uniform. This assures the constant air volume necessary for maximum dust collection

B. Sharp back pressure and air volume variations occur in rapping type filters when sections must be shut down for cleaning.

Separated Dust Streams ... One DAY

Autoclean" Dust Filter can handle several different product streams simultaneously without mixing. This is done by installing splitters in the receiving plenum and connecting tube rows to separate fan units as required. Individual screw lock feeders under each row of tubes discharge products separately. Thus one DAY Filter does the work of several individual units.



A. The BAY reverse air jet cleaning mechanism is gentle yet positive, cleaning each tube uniformly and permitting the use of high efficiency felt filtering cloth.

B. Tougher cloth with resultant poorer filtering quality must be used in rap-ping type filters. Cleaning effectiveness varies widely from point of vibration to where cloth is attached to filter.

Economy From The Start-You save money on original cost with a DAY Filter because you buy less filter to handle equal volumes of air. Continuousautomatic operation, minimum cloth area loss for cleaning and better filtering fabric permit use of less cloth and a smaller unit to handle your filtering requirements. In addition, less floor space is needed and installation and

maintenance costs are minimized.

856 3rd Ave. N. E., Minneapolis 13, Minn. IN CANADA: P. O. Box 70N - Ft. William, Ontario Branch Plants in Ft. Worth, Buffala and Welland, Ontario





News, cont. . .

side and partly in the Township of Gearhart, a mile and a half below Danville on the north branch of the Susquehanna River. Facilities include 19 major buildings and a number of smaller structures, plus a power plant, storage tanks, settling basins, and other installations.

The company's other manufacturing plants are at Rahway, N. J. (company headquarters), Elkton, Va., and Philadelphia. A Canadian subsidiary, Merck & Co., Ltd., conducts manufacturing operations at Montreal and Valleyfield, Quebec.

Foote Mineral Trims Prices On Its Lithium Compounds

Price reductions up to 10 percent, effective July 1, 1950, are announced by Foote Mineral Co., producers of lithium compounds used extensively in all-purpose greases, ceramics and porcelain enamels, air conditioning, welding fluxes and many chemical products. Direct savings from newly developed processing techniques make possible this action.

L. G. Bliss, manager of sales, states, "These savings in manufacturing costs are being passed on to users of lithium as a continuing policy of the company. In the past decade, the cost of many lithium compounds has been halved. As additional segments of our long-range research are reduced to commercial practice, further price reductions will be made."

Hypersorption unit to be built by Foster Wheeler for Dow Chemical Co. will be Dow's second. The new unit will have a charging capacity five times that of the first unit, which has been operating successfully since June 1947. Three pure product streams; namely, C-l's and lighter from the top, C-2's as the middle cut, and C-3's and heavier as the bottom fraction, will be separated from the cracking plant effluent.

Anhydrous ammonia, increasingly popular as a fertilizer for row and forage crops on the Gulf Coast, can now be used successfully in tung orchards. This is a result of engineering research recently completed by the Mississippi Experiment Station. The station has designed equipment that will place and seal anhydrous ammonia in the soil where the tung trees grow.

Vat dye production has been started by Tennessee Eastman Corp., Kingsport, Tenn., with jade green the first offered. A complete range of vat dyes will soon be in production. TEC says it is the only manufacturer of vat dyes in the South. The company has done research and experimental work on the application of vat dyes to viscose and acetate rayon fabrics.

New vinyl plant to be built and operated by the Carbide & Carbon Chemicals Division of Union Carbide & Carbon Corp. at South Charleston, W. Va., will be running by mid-1951. The plant will employ entirely new and different production methods. It will produce Vinylite resin VYNV3, which has been made on a pilotplant scale for about two years. This dispersion resin makes possible improved plastisols that speed up production. —End

READERS' VIEWS AND COMMENTS

Who Does Pay?

To the Editor:

Sir:—I think I am looking at the problem of your May editorial (p. 102) "Who Should Pay?" from a slightly different angle. I think the question is "Who Does Pay?" and the answer is: the worker himself pays all of it. He pays, it seems to me, either his own or his neighbor's.

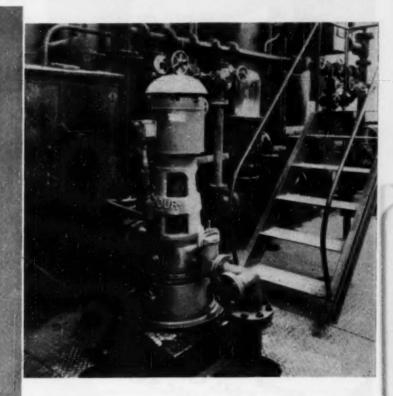
We have become so accustomed, in twenty years of New Dealism, to the idea that the "Company" is paying half the unemployment and old age benefits, that we think the company pays or can pay everything—all sorts of benefits. Actually, the "Company" pays nothing—the "benefits" are simply elements of cost and are therefore included in the purchase prices we all pay for everything: food, clothing, housing, entertainment, etc. (wherever social security taxes are applied).

What disturbs me is the nationwide acceptance of the something fornothing philosophy and the almost total destruction of individual initiative and personal responsibility. I feel that something for-nothing thinking is at least partly responsible for many other difficulties, e.g., increase in gambling, more crime-and-politics,

(Continued)

for DEPENDABILITY

they
specified
LABOUR



Here's a No. 10 LaBour Type G at work in a Chemco contact sulphuric acid system. The owners of this plant wanted dependability—freedom from costly process interruptions due to pump failures—and they got it when a LaBour was specified for the job.

LaBour Type G is the packingless, selfpriming centrifugal pump that has revolutionized old concepts of pump maintenance. Since it has no packing gland, it never needs attention for tightening or repacking. There are no rubbing or wearing parts anywhere in this pump, and aside from occasional lubrication of the bearings there's nothing to do to keep it working properly. That's minimum maintenance at minimum trouble and expense.

If you aren't already familiar with the overall economy and process efficiency which a LaBour Type G can deliver, we urge you to write for full details. If you'll tell us the facts about the particular job you have in mind, we can give you specific information that may be of great value to you.

ORIGINAL MANUFACTURERS OF THE SELF-PRIMING CENTRIFUGAL PUMP

LABOUR



THE LABOUR COMPANY, INC. & Elkhart, Indiana, U.S.A.



These rings stand up three times longer than those used be-

fore, and form a perfect seal by finger-tight gland pressure.

CRANE PACKING COMPANY

BELLE PLAINE AVE. . CHICAGO 13, ILLINOIS

READERS' VIEWS, cont . . .

more complacence generally regarding graft in government, etc.; and it facilitates the making of brazen demands by labor leaders without arousing any resentment in the general public.

To return, however, to the problem of social security (old age, unemployment, medical—the whole works), I believe that since we all pay the cost of it anyway, it should be set up as a compulsory insurance. Everyone would "then realize first the cost and then the value" and each could thus feel some pride in providing for himself. Incidentally, the cost would be less because a large part of the social security bureaucracy would be eliminated since the collection would be made as payroll deductions, and be-cause the accounting would be handled honestly instead of by the phony bookkeeping in Washington wherein no one knows whether or not social security is solvent. Once a compulsory insurance law was passed, the thing would be out of politics and out of labor deals.

We have a situation wherein everybody is being subsidized and everyone is being taxed to support everybody. In theory a welfare state isn't far from Communism. It seems to me that there are some indications that the time is about ripe to call a spade a spade. "Engineers and executives of chemical enterprise," at least those who read Chemical Engineering, can, in talking with the "men in the plant," help insure that they are "properly informed as they can be." The man in the plant, in my experience, is eager to listen to an engineer

who is at all human.

P. B. Kemball.
Boston, Mass.

We Fell Into Our Own Trap

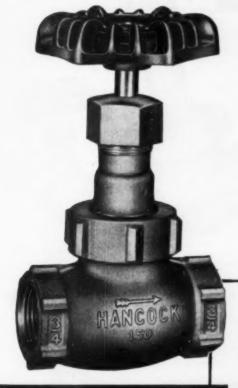
An article in our February issue entitled "Supply and Demand" discusses sulphur activity. Unfortunately, the paragraph entitled "More From Fuels" (p. 97) might be read to mean that the Worland plant of Texas Gulf Sulphur produced 70,000 tons in 1949 as compared with 16,000 tons less in 1948.

Our March issue misinterprets the February issue in just this way. Under the photograph (p. 177) we refer to the fact that Texas Gulf Sulphur produced 70,000 tons in 1949 against 16,000 tons the preceeding year.

The facts: Total sulphur from fuel gas was 70,000 tons. 1949; 54,000 tons, 1948. Construction at the Worland plant was not started until 1949 and operations began on April 8. 1950. —End

ANNOUNCING!

The New 150# Hancock "500 Brinell" Bronze Valve



Diaphragm construction of new 150= Hancock Bronze Valve 125% to 230% stronger than found in usual branze valves.

300# Valve Results at 150# Valve Prices!

"Super-Tough" is the word for the new 150# Hancock "500 Brinell" Bronze Valve. With a diaphragm construction equal to a 300# bronze valve, real strength and rigidity are built into this new bronze valve. Super-finished "500 Brinell" stainless steel seats and discs prevent leaks, cut maintenance cost to a minimum. Note the extra-rugged structure that means top ability to withstand expansions in piping systems, strains from installation and piping. Save money, increase efficiency, stop leaks. Install new 150# Hancock Bronze Valves.

For complete information, see your local distributor



Usual bronze valve diaphraam



Hancock diophragm



HANCOCK Valves

MANNING, MAXWELL & MOORE, INC.

WATERTOWN 72, MASSACHUSETTS



Makers of 'Hancock' Valves, 'Ashcroft' Gauges, 'Consolidated' Safety and Relief Valves, 'American' Industrial and "Microsen" Electronic Instruments. Builders of 'Shaw-Box' Cranes, 'Budgit' and 'Load-Lifter' Hoists and other lifting specialties.

The cylindrical body defies distortion

LUNKENHEIMER FIG. 2228 LINE UNION BONNET GATE VALVES

In this design of 200 lb. S. P. Bronze Union Bonnet Gate Valves. Lunkenheimer incorporates the first application of full cylindrical body sections in bronze gate valves. This construction, previously used only in higher pressure steel valves, provides great strength and maximum resistance against distortion of the valve body and seats due to internal pressure strains and other stresses. Tests made under conditions far more severe than those encountered in actual service prove that this design will not distort and will maintain initial proportions and seat tightness. In addition to the cylindrical body construction and other service-giving features, the valves are equipped with stems made of the distinctive silicon bronze alloy developed by Lunkenheimer to eliminate stem-thread failure due to wear.



Your Lunkenheimer Distributor will gladly show you how this valve's extra strength means extra service, extra value, too! Ask for Circular 534 or write direct.

ESTABLISHED 1862

THE LUNKENHEIMER CO.

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Bising Stem

Fig. 2228

Fig. 2230

The Human Equation

RICHARD L. DEMMERLE, Associate Editor

Industry Is Sold on the Men Who Buy

A few years ago the alumni association of a large midwestern university was holding a testimonial dinner in honor of its conference champion football team. As after dinner coffee neared the bottom of cups the toastmaster introduced the members of the team's "dream" backfield which contained a high population of All-America candidates. Each said a few words but took fifteen minutes to say them. The quarterback explained that his brilliance in calling plays would have amounted to naught if it had not been for the spectacular running and passing of the halfbacks. The latter in turn complimented the piledriving fullback, the menace of whose surges made it possible for them to be free to look great." This last shrinking violet pushed himself up from his eclair and summoned strength to wax eloquently upon the coaching talent that had made the team's record a reality.

Then, as a gesture to democracy in sports, the toastmaster asked the team captain, a lowly lineman, to rise and be heard. He did rise and was heard as he turned to the backfield end of the table and said: "Wouldn't you guys look silly—running, kicking, passing, dodging and blocking—and in front of 70,000 spectators—if the center didn't pass the ball back to

It may be reaching for an analogy but the above incident seems to serve well to illustrate the position and importance of the industrial purchasing agent. The quality of the raw materials and equipment he buys makes the task of the production man easier. And the economies he effects in buying them put his company's leading ground gainer, the salesman, in a better position from which to score.

Like the center on the football team, the purchasing agent's performance is often taken for granted. His good moves are rarely applauded and condemnation is quick to be dumped upon his head if material arrives a day late or of a quality inferior to that requisitioned by the plant. About half the time such mistakes should be chalked upon against the supplier but the purchasing agent, being closer at

hand, usually bears the full brunt of the outraged plant manager's wrath. Perhaps the unkindest cut of all

to the P.A. is to hear himself described as a penny-pinching dyspeptic grouch who breaks down his sales resistance and places an order only when the firm is on the verge of shutting down operations for want of raw materials. His personality, these critics claim, is akin to that of a rattlesnake with a toothache and his diet is supposed to consist of salesmen who are first paralyzed by the horror of his icy leer.

Any lingerings of this impression, if ever founded in the past, are quickly dispelled by a visit to the office of a modern industrial purchasing agent. Visitors, salesmen included, are welcomed by an interested management minded executive, well acquainted with his company's operations. The warmness of the reception may indeed cause the guest to glance at the lettering on the door to make sure that he has not wandered into the sales department by mistake. Another reason for confusion on this score is the fact that several men in major purchasing positions are ex-salesmen. Conversely, many successful salesmen give due credit for their success to the years they spent on the drawer side of a purchasing desk.

A cheap purchase is money lost

Japanese Proverb

The most surprising thing to be observed during a sales interview with today's P.A. is that the question of prices may arise only late in the first conversation with him, if at all. The dollar sign must stand in line behind questions about the product's quality, properties, uses, and long term availability.

To this end industry now hires and develops engineers and other technically trained men for purchasing positions. George A. Renard, executive secretary of the National Association of Purchasing Agents, revealed to this column that an estimated 40 percent of major purchasing posts are now held by men with engineering train-

ing or experience. "This," he said, "represents a fourfold increase over the percentage figure of 20 years ago and it must be remembered that during the last 20 year period the total number of people in the field of purchasing has tripled."

The priority and scarcity ridden days of World War II made many previously unconvinced chemical managements see the value of having technical men do the buving job. The technical P.A., completely familiar with the needs of the process or plant for which he was buying, was able to accept or reject available substitute materials on the spot, without constant recourse to the plant manager for decisions.

In the years since the war several chemical process companies have adopted semiformal programs for the development of technically trained purchasing agents. Young engineers, directly out of college or with previous industrial experience are put on a planned junket through several of the company's plants. The aim is to familiarize them with the needs of the individual plants, but more important, to allow them become acquainted with the various plant managers with whom they must later work on a team basis.

In this circuit of the company sites the P.A.-to-be spends a tour of duty in the research of development laboratories of the company. Here the neophyte sees processes in the making and begins to realize the importance of anticipating the material and equipment demands of a process long before it reaches a commercial scale. Just as in his plant assignments, the stay at the research laboratory serves the other vital purpose of giving him a chance to meet and work with the men whose ideas and activities can only be implemented by the supplies he procures for them.

The business end of purchasing is unfolded to the trainee during a period of indoctrination in the home offices of the company. Accounting procedure, insurance regulations, contract legalities, traffic operation, inventory control and market analysis are only some of the topics he must master before he may be considered for his initial purchasing assignment.

(Continued)



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HUMAN EQUATION, COUR. . .

The chemical process industries can claim a rightful place along with the automotive, metal and electrical industries as forerunners in this field of purchasing-engineering. In fact it can be said that sooner or later the purchasing department of a major chemical process company is concerned with the technical properties and commercial aspects of every raw material and every finished product in all of industry!

The buyer needs a hundred eyes . .

G. Herbert's Proverbs, 1639

To provide the versatility yet specificity of training and experience required to tackle this immense job, most central purchasing departments in the CPI consist of specialized buying divisions cach devoted to a given classification of raw material or equipment. These divisions are frequently subdivided into smaller groups concerned with the procurement of major items that fall under the divisional heading. "Basic Raw Materials," for instance, is a typical division title, but individuals or groups working in this division will be charged separately with the purchase of phosphate rock, limestone, salt, coke, etc.

Individual divisions are headed by men with previous operational experience, a technical degree, or both. Modern purchasing practice often puts chemical engineers in charge of the "Basic Raw Materials" and "Chemicals" divisions, a mechanical or a chemical engineer in charge of the "Process Equipment" division, and an electrical engineer at the head of the Electrical Equipment" division. Specialists in their fields are also found leading the divisions concerned with "Plant Maintenance and Mill Supplies," Laboratory Equipment and Supplies," "Materials Handling" and "Salvage and Reclamation."

"Salvage and Reclamation."

The "Services" division of a CPI purchasing organization is concerned mainly with negotiations for outside services, such as construction work, the fabrication of special process equipment and the like. Invariably this division is headed by a man with broad engineering training and ex-

perience.

The organization of purchasing in most companies in on what is often termed a "centralized-decentralized" basis. The bulk of the buying is done by the central purchasing office but various large plants or operating division of a company are often provided with purchasing groups of their own.

(Continued)



There was trouble at the centrifuges. Not that they weren't efficient...they just could not handle the excessive loads of the coarse foots in the oil being processed.

It was in a fish plant on the East Coast. Inedible menhaden was being converted into rich animal-feed and commercially-useful oils. With the existing process, the maximum productive capacity of the plant could not be attained. When the centrifuges were overloaded, output dropped—and with it went deliveries and profits.

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HUMAN EQUATION, CORt. . .

The latter are usually given considerable freedom in their mode of operation but they must hew to the line of purchasing policy formulated in the central office. But in matters of administration the head of a branch purchasing office is responsible directly to the plant manager or the divisional superintendent, as the case may be.

There is more to modern purchasing, however, than a well organized buying network. The efficient purchasing man must keep abreast of plans and activities within his entire company if he is to function with foresight. Production, management and even sales conferences include him as a welcome member and his observations on commodity trends and markets often become the groundwork for future company-wide planning.

In return these conferences provide him with the information he needs to shape his buying program. Is labor trouble at Plant A going to force a shutdown? Is the raw material inventory at Plant B too large to carry economically? Will new local anti-pollution legislation make it necessary to buy and install smoke control equipment at Plant C?

The outside world also commands a good portion of the purchasing agent's attention. One P.A. recently told the writer: "Reading a newspaper may be relaxation to some people but to me its just asking for worry. The news report of a flood, fire, explosion, or a strike in an industrial area means a sleepless night—and the early fragmentary account of a train wreck makes me dread showing up at the office the next morning."

Ken when to buy.

Scottish Proverb

The salesman's presentation of data about a new material or piece of process equipment is carefully weighed by the technical P.A. If he finds it holds promise the data are forwarded to a special group in the engineering or research department that works in close liaison with the purchasing department on the investigation of new products and equipment units. If this laboratory group agrees that the suggestion has merit, a sample of the product or device will be obtained and put through its paces. The test run report enables the P.A. to recommend to the production department whether or not the proposed item should be considered for use in the plant.

The commodity picture of the industrial world is presented to the (Continued)

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HUMAN EQUATION, CORL . .

purchasing agent in the form of reports from a market analyst who may work directly as a full time member of the purchasing department or who who may be assigned to it from the market research department. This individual not only investigates the market conditions surrounding the materials used in the company's operation but those that might be used in the future.

Many companies in the chemical process industries have adopted the practice of sending their purchasing men on inspection trips of the suppliers' plants. This gives the P.A. an opportunity to get a first hand view of that part of industrial activity that affects him most-the suppliers' production facilities. These visits are also arranged to bring him into contact with the men who by a little efforta little personal touch-make him the more efficient and reliable purchasing man. Many are the shipments that are pushed through on time in spite of many obstacles just because "not to deliver would make our old friend Joe, the P.A., look bad in his company.

One purchasing man expressed this idea as somewhat differently to the writer when he said; "The old days of the P.A. sitting behind his desk expecting the salesmen to offer up gifts are gone . . . today we have to go out and visit our suppliers and be awfully nice to them . . . von never can tell when or where a sellers' market is apt to develop."

No article about the function of purchasing would be complete without mentioning the basic economics involved in the job. This can be put simply in the form of two statements: (1) The purchasing agent spends an average of one half of the company's annual operating dollar. (2) A \$5,000 saving in a purchasing operation is the equivalent of an additional \$100,000 of sales for the average company. Truly a penny saved is a penny earned!

If the purchasing agent was ever an auxiliary member of the industrial team he certainly can't be regarded as one today. Few executives in a large modern process company have a greater sense of the over-all extent of the operations than he. And none has a better understanding of how the rise or fall of the enterprise depends upon its ability to integrate itself efficiently with the entire industrial economy. Since this type of savvy is also the hallmark of management timber, the modern purchasing department represents a major source of the management material of the future.

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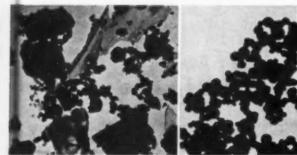
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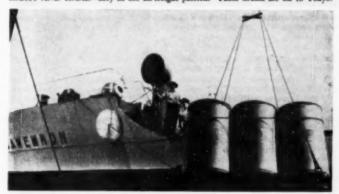
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R. W. LAHEY, Editorial Consultant



LIGHT AND RIGID-they fit the air-freight pattern. These drums are off to Tokyo.



DURABLE-They can take sea-trips with safety. This load is headed for Venezuela.



LONG LIFE.—This drum went to Europe carrying dry milk and returned here with a Swiss product two years later.



LININGS-Polyethylene and other linings are used to keep product dry and free from impurities.

Packaging Notebook-IV

FIBER DRUMS

There have been several major changes in chemical packaging practices in the last 25 years. One of the most significant of these is the adaption of the fiber drum to meet the highly specialized packaging requirements of chemical and pharmaceutical compounds. The construction of the fiber drum lends itself admirably to the need for a "tailor-made" package as evidenced by the many special constructions devised to provide the proper protection for individual products. In addition to these special types of drums, containers of the standard or basic construction are widely used.

General acceptance of this container followed the development of machinery for convolutely winding the drum bodies and the improvement in the all kraft liner board. In addition to these two basic improvements many other changes have been brought about by the untiring efforts of the makers of these containers. The task was particularly difficult because no standard machinery or equipment was available. Improvements in container construction thus had to be followed by individual development of machinery before the improved containers could be fabricated on a production basis. The work, due to intensive efforts of the manufacturers, has been accomplished in the last two decades. The industry had just completed their development program at the outbreak of the last World War. Somehow they were able to tool up to meet the greatly increased requirements of the war economy. Their principal role during this period included many war packaging jobs such as the development and production of containers for packaging bomb clusters for the Air Force. They also were called upon to supply exceedingly large quantities of fiber containers to replace steel drums and thereby conserve steel.

Each manufacturer of these containers has developed a particular construction—the only standard being the (Continued)



1-Wood headings, standard metal band closure.



2-Metal bottom, plywood top, Lok-Rim closure.



3-All-fiber style, headings are recessed on this type.



4-Standard metal bound, lug fasteners are used here.



5-Fiber pail, with or without bail. Note taper.



6-Metal top drum, with metal 7-All-fiber style, headings are bottom. Narrow opening.



recessed in this type.



8-Metal top drum, with metal bottom. Wide opening.

PACKAGING, cont. . .

convolutely wound shell. Methods of attaching the bottoms vary greatly as do the means used to secure the covers. These differences also extend to the methods used to introduce water vapor and other protective barriers and linings into the sidewalls and heads of the packages. These many variations in the construction details of fiber drums offer many possibilities for the solution of problems.

Fiber drums of the convolutely wound type entered the chemical packaging field a little more than 20 years ago. Prior to that time, they had been used for packing certain meat and other food products. One of the first chemical products to be packed in these containers was urea formaldehyde molding powders - in fact they are still the standard containers for this molding compound. They performed this difficult job so well that the use of these drums spread rapidly to many other compounds.

These drums when used for rail transportation must be fabricated to meet the specifications in Sec. 12 of Rule 41 of the Consolidated Freight Classification Committee. Some constructions have been approved by the ICC (Spec. 21A) for shipping containers for certain Class B poisons, inflammable solids, oxidizing materials

and even dynamite. They are also authorized as outer shipping containers for some inflammable liquids packed in glass bottles.

Many types of water vapor barriers and linings are used in the sidewalls and heading of fiber drums. Some are buried in the sidewalls, some are used as inside linings and others are used as exterior coatings. Each manufacturer has developed a specific method of incorporating these coatings, linings and barriers into his particular construction. Exterior coatings are usually sprayed and dried by passing through heated tunnels or by infrared lamps. Some linings are sprayed directly into the containers, such as paraffin wax, silicate of soda, amorphous wax, rubber compounds, and certain synthetic resins.

In addition, linings known as free stripping compounds can be applied by spraying. These coatings prevent products which are poured as hot liquids from sticking to the container.

Barriers and linings consisting of laminations of paper board with asphalt, or of paperboard with metallic foil and resin are primarily used for water-vapor protection. Linings such as aluminum foil, glassine, cellulose acetate, pliofilm, and polyethylene, are used not only for moisture protection but also for cleanliness and chemical resistance. The films are

coated on to the kraft board, or they are laminated. In some instances, the barriers are laminated between two sheets of the board. Asphalt laminated board can be used in conjunction with other vapor barriers such as polyethylene, pliofilm, etc. Laminants include asphalt, wax and synthetic resins.

Loose bag liners are also used as vapor barriers in fiber drums. At present, liners fabricated from polyethylene saran, etc. have broad application for packaging pharmaceuticals, pastes and compounds containing a substantial percentage of water.

The methods employed in attaching metal, wood and fiber headings to convolutely wound fiber cylinders are the most important feature of the construction of these containers. In fact, the ability of these containers to withstand unusual transportation abuse is dependent on the strength of this joint between the head and cylinder of the drum. Fiber heading is fabricated so that it is either slipped over or recessed inside the cylindrical bodies of the drums. The recessed type is usually fastened by metal clips or wire stitching while the telescopic or slipover type is secured to the drum by the use of gummed paper, cambric, or pressure sensitive tapes. Metal and woolen headings are held with metal locking bands or rings. Some metal headings are wire stitched



9-U-Pak is used to carry rolled materials.



11—Metal top and bottom. Note retaining clamps.

to the drum while other types are held by metal clips.

Fiber drums are fabricated in sizes from 1 gal. to 75 gal. capacity. Diameters vary from 8 in. to 23 in. and heights from 3 in. to 42 in. For special applications, longer containers are available. These containers can be obtained in almost any size in this range. They can be used for transporting up to 400 lb. in a single drum and sometimes even greater weights may be packed of certain commodities if special authorization is procured. Each capacity of most of these containers is ordinarily fabricated in two diameters. This allows nested shipments of the empty drums which reduces transportation costs.

Having no rolling hoops or bilge, fiber drums require less storage space than most cylindrical containers. Tare weights are also favorable to fiber drums. Of the rigid containers ordinarily used for packaging dry compounds in the 41 gal. size, the fiber drum weighs about 17½ lb. the 24 gs. steel drum approximately 23 lb.



10-Stapak is equipped with metal top and metal bottom.

and the slack barrel about 25 lb. Drums may be obtained in a choice of extenrior finishes. Clear varnish coatings provide a degree of waterproofness, dust and dirt does not settle as readily on the smooth surface and the walls can be cleaned with a wet cloth. They can be painted in a large variety of colors and can also be printed with rubber dies and by the silk screen process. Labels are an effective means of decorating, but special adhesives are required when applied on varnished or painted surfaces. It is the usual practice to stencil shipping and other information on the walls or heads of these containers. Special stencil inks are required when drums are coated with paint or varnish. If it is desired to use tags or cars instead of stencils for marking shipping data, special fittings to hold these tags can be applied to the drum heads by the manufacturers.

Proper handling of fiber drums differs somewhat from the practices customarily used in the moving of steel containers and wooden barrels. Fiber drums should not be rolled on their sides except in storage racks which are designed to support them at their chimes. Gravity or powered roller conveyors are effective methods of moving these containers. Conventional two-wheel hand trucks can be used for occasional or limited handling. Truck of special design can be used more effectively where these containers are handled in large quan-

Fiber drums may be palletized and tiered within certain limits. The height to which these containers may be safely tiered depends on the construction of the drum. In general, loads of 1,000 lb. should not be exceeded. For authoritative information on this matter the manufacturer should be consulted.

Fiber drums should be loaded into freight cars in the nested or staggered pattern conventionally used in loading cylindrical containers. All bracing and strapping should be supported at the (Continued)

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12-Fiberpak is another allfiber type drum.

PACKAGING, cont. . .

top and bottom chimes. Bureau of Explosives Pamphlet No. 6 and American Association of Railroads Pamphlets No. 4 and 14 give complete recommendations on proper carloading and staying methods.

In 1946, the Manufacturing Chemists Association published a manual on the handling and storage of fiber drums when filled with chemicals or allied products. Copies may be obtained from the Washington offices of the Association.

These containers have many special uses. Rolled films such as cellophane, foil, photographic and X-ray film, etc. are packed in fiber drums because the edges of the rolls are protected against damage. The drums are popular for packing fragile articles protected with inner cushioning material such as cork, sponge rubber, Kimpak, shredded paper and single face corrugated in coils. A unique application is the special construction container which is used to hold 50 lb.



13-Leverpak drums are recognized by the closing clamp.

of dynamite. The fiber tube serves a double purpose—it is both the shell or cartridge in which the dynamite is packed and also it is the shipping container.

Industry has found that fiber drums not only have exceptionally protective features for their products but they are universally accepted by their customers. The trade appreciates the ease of emptying, complete reclaima-tion of contents, reclosure feature, light weight, and reuse possibilities of these containers. If the accomplishments of the past are an indication of what we can expect, further major improvements in fiber drums may be looked for.

More ICC Regulation Changes For Your Files

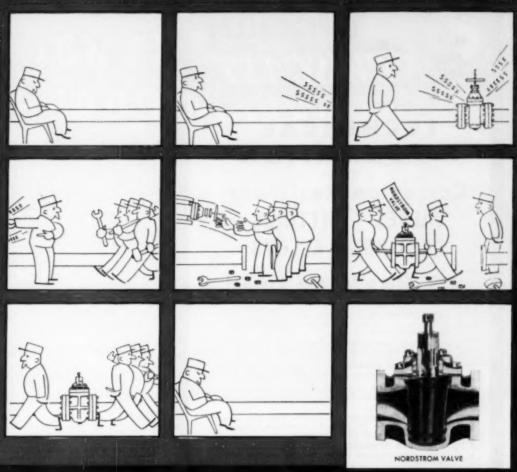
SEC. 192(h) FOODSTUFFS are exempt from the packing requirements for COM-PRESSED GASES when packed in metal cans charged with soluble non-liquefled compressed gas, provided pressure in con-tainer does not exceed 105 pst. absolute at 75 percent P. or 146 lb, pst absolute at 139 deg. P. The metal container must (Continued)

Specifications for Fiber Drums Carrying Solid Materials

				-Tops	and Bottome	(ench)-	
Maximum		Side-Wall	Fiberboard o Waterpro	ster ply		Wool Thickness	
(Lh.)	Capacity (Cal.)	Tess per Pat."	Thickness (In.)	Tout (Lb.)*	fitted U.S. Ga.)	Solid (In.)	Plywood (In.)
20	1.0	280	0.080	400	200	2/6	1/4
60	30	350	0.120	800	30	1/2	3/11
125	4.5	500	0.160 0.120	800	28.	1/2	3/10
150	5.5	600	0.160 0.120	800	28	1/2	2/8
200	65	200	0.180	1,000	26	1/2	3/8
2060	75.	500	0.200	1,100	26	25/32	7/16
6(8)	75	900	0.240	1,200	34	25/32	7/16

"When more than single ply, tent may be determined by multiplying tent of single sheet or ply by the number of laminations or plys.

Sidewalls may be constructed of fibreboard of single ply with outer face waterproofed and the ends of the fibreboard forming joint or overlap most extend at least 2 in. beyond beginning of the overlap and must be firmly glund together throughout entire area of overlap and such overlap must be rainfered by metal rivets, staples or slitches not more than 6 in. apart or must be fastened by a double row of metal rivets, staples or slitches not more than 2 in. apart in each row, or secured by a barbed steel strip not less than 2 gs. and not less than 1 in. wide extending entire length of joint with barbs pressed through fiberance of the property of the property



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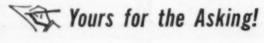




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The COOPER ALLOY FOUNDRY CO.

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PACKAGING, CORT . . .

be capable of standing without burnting two times pressure of contents at 70 deg. F. or 15 times the pressure of the contents at 130 deg. F. whichever is greater.

SEC. 303K and (q.) (1) METHITL MEER-CAPTAN is a compressed gas and may be packed to a maximum filling density of 40 percent in Spec. 2A246, 2B246, 4B246, and 4BA340 cylinders. Spec 166A-500 task cars are also approved when filled to a maximum filling density, of 30 percent.

SEC. 303(1) ACETYLENE GAS. Changes have been made in the solid rubber or other suitable material when approved as to type and construction by the Bureau of Explosives.

the Bureau of Explosives.

SPEC. 5P. LAGGED STEEL DRUMS are designed for transporting ethylene oxide. This container is constructed of an inner straight sided steel drum lagged with suitable fire resistant material having insulating properties. This insulation is covered with a metal shell so constructed that moisture cannot come in contact with the lagging. Maximum size is set at 41 gal. capacity and the container must be equipped with safety devices to prevent bursting when drum is placed in a fire.

placed in a fire.

SPEC 8 STEEL CYLINDERS FOR
ACETYLENG Changes have been made
in the specifications for the porous material with which these cylinders are
filled. The maximum amount of acotone
solvent permitted has also been slightly
forwased. Additional types of steel for
falcating these cylinders have been
added to the approved list. Welding of
attachments to tops or bottome of beckrings, footrings, handles, bosses, pads,
and valve protecting rings is authorized
when certain types of steels are used.

SPEC. 23F. SOLID FIBERBOARD BOXES. When used for packing ELEC-TRIC BLASTING caps not exceeding \$5 ib. gross weight, lining tubes are not required.

SPEC. 50. UNLAGGED PORTABLE TANKS. This specification has been cancelled.

SPEC. St. PORTABLE TANKS. Certain details of the construct-amount of solvent required in cylinders holding this gas.

SEC. 384(r) COMPRESSED GARES SHIPPED IN CARGO AND FORTABLE TANKS. This section of the regulations has been enlarged to include retailed instructions covering permitted tank specifications for various types of gase, maximum filling densities, gaging devices, safety valves, etc.

SEC. 340(c) ARSENIC ACID. Spec. ID carboys have been added to the list of approved containers.

SEC. \$41(c) CARBOLIC ACID (PHE-NOL) LIQUID. Spec. 1D carboys have been added to the approved containers.

been added to the approved containers. SPEC. 3P METAL CONTAINERS. This new single trip container provides for a maximum capacity of 30 cu in. (16.8 fluid oa.) with a maximum inside diameter of 3 in. 1t must be esamless or have joints welded, braned, or noldered. They must stand a minimum pressure of 150 psi without buiging. They are double seamed or swedged, single containers which must be shipped in outer shipping containers.

SPEC 5A. SPEC 5, SPEC 5B. SPEC 5C. SPEC 5G, SPEC 5M. RETURNABLE STEEL DRUMS may be equipped with rolling hoops of plable ion of these tanks have been altered.

SEC 401(a) (1) MARKING OF PORT-ABLE TANKS. It is required that portable tanks be compleuously and legibly marked on a background of contrasting colors when used for transporting dangerous articles. Complete details of lettering are included.

-End

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- 1 Zeo-Dur-A processed glauconite (naturally occurring green-and).
- 2 Decalso—A precipitated gel type sodium aluminosilicate. Regenerated with salts.
- 3 Zeo-Karb-A sulfonated coal having -SO,H, -COOH, -OH exchange groups.
- 4 Zeo-Rex-A sulfonated phenolic type cation exchange resin having -SO₂H and -OH exchange groups.
- 5 Permutit Q A sulfonated styrene type cation exchange resin having only -SO₃H exchange groups.
- 6 Permutit H_Acarboxylic acid resin having -COOH
- 7 De-Acidite_An aliphatic amine anion exchange resin of high reaction speed, tough structure and high capacity.
- 8 Permutit S_A highly basic anion exchange resin.

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ALOMINUM BRONZE

CUPRO-NICKEL "30%"

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PLANTS IN DETROIT AND DECATUR, ALA.
Sales Offices in Principal Cities

News From Abroad

(Continued from page 123)

the terms of a barter-type trade agreement recently negotiated for the exchange of \$16 millions in goods.

Allies Spike Rumors of New German Oil-From-Coal Work

Frankfurt—The once vast German Fischer Tropsch synthetic petroleum industry is, in the words of a leading official of the American High Commission's fuel and power branch, "as dead as a duck and will remain so as long as we can see to it."

The official was commenting on rumors that German Fischer-Tropsch plants in the Ruhr were still producing petroleum out of coal in spite of a firm Allied ban. He said the last two plants working on the Fischer-Tropsch method closed down on Dec. 31, 1949, when a temporary Allied production permit for a monthly output of 5,000 tons of primary products expired. This permit had been given in June 1947.

German industrialists, however, are still hoping for an eventual withdrawal of the ban on synthetic petroleum production under the low-pressure (Fischer-Tropsch) method. Notably members of the coal processing industry have been encouraged in this hope by the fact that the six West German Fischer-Tropsch plants in the Ruhr, together with four hydrogenation plants, were exempted last December by the German-Allied Petersberg agreement from further dismantling.

Though petrolcum production by the low-pressure, Fischer-Tropsch method is prohibited, two German works, the Gelsenberg Benzin AG at Gelsenkirchen and the Union Rheinische Braunkohlen-Kraftstoff at Wesseling are making petrolcum from crude oil by the high-pressure Bergius hydrogenation method. These two plants are refining German and imported crude oil.

The Wesseling plant, working at about half its original capacity, operates o na contract with the Shell Oil Co. The Gelsenberg plant, working at about one-third of its original capacity, is under contract with the New Jersey Vacuum Oil Co. The two

plants have been free from Allied restrictions since last autumn. Though the Allies originally decided to revive them only on a limited scale, part of the Gelsenberg plant was dismantled and shipped abroad as reparations.

The two plants are expected to process I million tons of crude oil this year, and Allied experts expect them to reach 2 million tons by 1952. This estimate is mainly based on rising German crude oil output.

New drilling equipment has been brought in, drilling methods improved and brought up to modern American standards, new wells have been opened, and existing holes sunk deeper. In particular new fields in the Emsland, near the Dutch border, are being exploited with American-manufactured portable drilling rigs, bought by the Germans with \$1 million of ECA funds. This equipment, which is transportable on trucks, has proved far superior to the old German drilling equipment.

German crude oil production from fields in the Emsland, around Hanover, near Hamburg, and poor fields south of Stuttgart, which in 1936 amounted to 445,000 metric tons, rose by 1948 to 635,700 tons, and in 1949 to 845,500 tons, according to British Control Commission reports. German crude oil, especially the very heavy Emsland oil, is of low grade, only about 90 percent of it being fit for processing.

Egypt Plans to Expand Phosphate Operations

Cairo—Direct or indirect government aid to companies engaged in the extraction of phosphate in Egypt is urged in a report drafted by the Egyptian Ministry of Commerce and Industry. The report points out that large quantities of phosphates of lime are being exported every year, mainly to Australia, New Zealand, Italy and Spain. (Acording to official figures, exports of phosphate of lime in 1949 amounted to 145,622,636 kilograms.)

There are two local firms at present engaged in the exploitation of phosphate mines in Egypt; the Societe Egyptienne pour L'Extraction et le Commerce du Phosphate, which employs some 1,650 workers; and the

Societe Egyptienne du Phosphate, which employs some 580 workers.

Swedish Chemical Output Still Growing

Stockholm-Sweden's chemical industries will increase their production volume by just over ten percent compared with 1949, according to a forecast by the Swedish Board of Trade. Sweden's total exports of chemicals, matches, explosives and concrete last year were valued at approximately \$28,950,000 corresponding to 3.5 percent of Sweden's total exports.

Celanese Expands Mexican Rayon Output

Mexico City-Celanese Corporation of America's two Mexican affiliates are expected to increase their output by nearly 75 percent this year. Celanese Mexicana, at Ocatlan, which is turning out 12 million pounds of acetate filament annually, is scheduled to step up production to 14 million pounds of filament yarn plus six million pounds of staple; the other affiliate, Viscosa Mexicana, at Zacapu, is expected to be producing six million pounds of staple by the end of this year in addition to the present seven million pounds of filament. Plans for 1951 envisage a production at the Ocatlan plant of 20,000 pounds of acetate filament and eight million pounds of staple fiber and at the Zacapu facilities an output of 12 million pounds of filament and 12 million of staple fiber.

Belgium Refinery - Antwerp - Construction is now under way of a complete 30,000 bbl. per day refinery for the Societe Industrielle Belge des Petroles at Antwerp. The refinery is on a site adjacent to the Scheldt River. Completion is scheduled for mid-1951.

Achema IX—Frankfurt—This month (July 9-16)—after a lapse of 13 years—the 30-year tradition of the Achema was renewed. This year the exhibition and convention occupies eight large halls at the municipal fair grounds in the city of Frankfurt.

French Chemical Exports—Paris—The French chemical industry is in the midst of 'an investment program sponsored by the Monnet Plan which aims to double exports of chemicals by 1952.

(Continued)

Problem: Venting a dangerously Solution: BS&B SAFETY HEADS



Should external fire exposure—a sudden excessive pressure generation—or an internal fire and chemical reaction get out of hand-would your existing relief valve meet such an emergency?

> BS&B SAFETY HEADS are the solution for dangerously fast pressure rises. They give INSTANT RELIEF! A fully unrestricted opening is made for gases and liquids to escape. No other relief device acts as fast as the BS&B SAFETY HEAD.

> There are three principal parts...a pre-formed metal rupture disc and two specially designed metal holding flanges. Correct element resistant metals are used in fabrication of the rupture disc which bursts when a predetermined pressure is reached. BS&B SAFETY HEADS are used the world over. There are no moving parts to wear or become fouled at a critical moment. SAFETY HEADS give round the clock protection to both property and personnel.

Here Are the Answers to Your Relief Valve Problem -

1. As sole pressure relief device

This installation is used when it is not necessary to have a shut-off or when materials handled are not taxic or inflormoble.

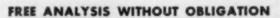
2. At outlet of certain types of relief valves

A SAFETY HEAD at the relief outlet will stop leakage until rupture disc pressure is ottoined. Not recommended where viscous or corrosive materials might contaminate internal parts of the valve. Investigate your valve design before using this type of installation...



3. Under your existing relief valve

A SAFETY HEAD under your relief valve isolates the valve from vessel contents. Leakage through the valve is eliminated until the SAFETY HEAD rupture disc is burst by over-pressure. An open bleed line or some type of tell-tale indicator must be installed in chamber between rupture disc and valve plus.



Jim Myers, BS&B SAFETY HEAD Sales Manager will have a BS&B engineer analyze your pressure relief problems and submit suggestions to you WITHOUT COST OR OBLI-GATION. Mail the coupon on opposite page or call GRand 6700. Kansas City. Do it now!

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fast pressure rise...



Get all the facts...all the answers to your questions about BS&B SAFETY HEADS! The latest up-to-the-minute information on the use of BS&B SAFETY HEADS in the Chemical Industry is contained in a new catalog. You will receive a copy by mailing the coupon below to Black, Sivalls & Bryson, Inc.

Extra Protection for Expensive Equipment



4. As a secondary relief device

When the SAFETY HEAD is used as secondary relief device you are qiven positive protection when pressure of the predetermined is unstained pressure of the rupture disc. The primary relief valve may fall be function due to corrosion, or if pressure continues to rise, due to inadequate ryling area.



BLACK,	SIVALL	S & BRYSO	IN, INC.
720 Delaware,	Sec.	4-5-7,	Kansos City, Mo.
BS4B SAFETY HEAD catalog.	the new	Please seer as cost or	have a BSAB SAFETT HEAD ong calyze my relief problem, withou obligation to me.
Name			
Firm.			
Title			
Address			
City		Inne	State

FOREIGN NEWS, cont. . .

Canadian Alcohol-Ottawa-Commercial Alcohol Co.'s plant at Gatineau, Que., is currently running just about at 2,000,000 gal. annually. A year ago it was running only approximately 50 percent.

More Power at Trail—Ottawa—At a cost exceeding \$300,000 Consolidated Mining and Smelting Coplans to increase the electrical facilities of its chemical and fertilizer plants at Trail, British Columbia. This major revision has become necessary through the gradual expansion of the plant during the past few years.

Canadian Gas—Ottawa—Imperial Oil Co.'s \$4 million natural gas processing plant at Devon in the heart of the Leduc oilfield in Alberta has been opened. About 90 percent of the plant's production will be "dry" gas which can be used for domestic or commercial demand. When in full operation the unit will also produce several hundred barrels per day of "natural" gasoline suitable for blending with refinery stocks into motor gasolines.

Durban Refinery — Johannesburg — An oil refinery, which will cost between £5,000,000 and £6,000,000, may be built in Durban. Negotiations are being conducted by Harold Moore, managing director of a Durban registered company (the Union Petroleum Refinery (Pty.), Ltd.,) and the Government. The proposed refinery, which will take two years to build, will handle more than 500,000 tons of crude oil a year. Its main products will be gasoline, lubricating oils and fuel oils.

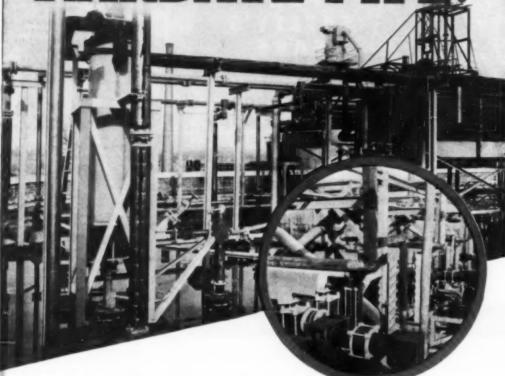
Atomic Sieve — London — An electromagnetic isotope separation plant has just been completed at the Ministry of Supply Atomic Energy Research Establishment at Harwell, Berkshire. It can "sieve" the atoms of heavy elements such as uranium, dividing them according to slight variations in weight.

German Potash – Frankfurt – West German exports of raw natural potassic salt, potassium chloride, potash sulphate, and potash-magnesia sulphate—which were initiated in July 1949—reached a total of 75,221 metric tons K₂O in the first quatter of this year according to the Bizonal Potash Sales Co.

-End

For any or all corrosive jobs...

KARBATE PIPE



Advantages of "KARBATE" equipment are:

- Both acid-resistant and alkali-resistant
- Light in weight, easy to machine and assemble
- No metallic contamination of product
- 6 Immune to thermal shock
- Very high thermal conductivity

WHETHER your corrosion problem involves a little 100-foot "nuisance" pipe line . . . or the outfitting of a complete chemical plant, "Karbate" impervious graphite equipment offers an economical and efficient solution. "Karbate" pipe, fittings, and related equipment are the best obtainable for conveying, processing or storing practically all corrosive fluids.

For complete details, write to Mational Carbon Division, Dept. CE

NOW...double light at no extra cost!

Specify the new and improved "Eveready" 1050 flashlight battery and you get more than double the usable beilliant white light for critical uses than is available from any other flashlight battery National Carbon has ever made. The bottery is leadproof ... NO METAL CAN TO LEAK OR CORNODE!



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The Corrosion Forum

EDMOND C. FETTER, Managing Editor

How to Be Happy With Teflon Packing

Tellon can give long trouble-free service, but there are three main things that have to be right. Your packing must be properly compounded, precision fit, carefully run in.

Power Products Co., a prominent producer of Teffon packing, has prepared this article at our request to help you get the exceptional service you expect of an exceptional material.

As a packing material for chemical pumps, the inert qualities of Teflon leave nothing to be desired. Physically, however, while its appearance is that of a low friction material, it has proved to be totally unsatisfactory on rotating shafts. In most cases, in its pure state, it will adhere to the shaft and rotate with it, causing extreme overheating and eventual failure. In other cases, it will soften at the point of contact with the shaft due to excessive frictional heat and gradually wear away leaving an annular space along the shaft permitting excessive leakage.

COMPOUNDED, NOT PURE, FOR ROTATING SHAFTS

After a great deal of experimentation, satisfactory chemical packings for rotating shafts have been developed. For instance, as produced by Power Products Co., this packing is composed of very thin shreds of oriented Teflon fibers; orientation provides a material having molecular alignment and, consequently, low frictional qualities. These fibers are compounded with chemically resistant friction reducers, usually graphite, and molded into packing rings under extremely high pressure. This "compounded Teffon" packing material has a very low coefficient of friction and retains the corrosion resistance of pure

Compounded Teflon packing is not adversely affected by high peripheral shaft speeds and will seal a stuffing box efficiently with very slight gland pressure, thus assuring its user of a minimum of shaft wear or overheating.

Nearly all conventional chemical or solvent packings fail eventually because corrosive or solvent action of the product being handled removes the lubrication in the packing. This gencrally results in costly leakage and, in most cases, more costly wear to the shaft or sleeve. Compounded Teffon packing contains no lubrication and, unlike asbestos packings, does not rely upon the retention of its lubrication for continued functioning. The component parts of these Tellon packings are chemically inert and for this reason do not require a chemical or solvent resisting lubricant to operate effi-

The method of installing Teflon packing is most important. The set of packing should include & in. thick spacer rings between the packing rings and at the top and bottom of the stuffing box. This practice has been found most successful. spacer rings are made of pre-shrunken pure Teflon. Their function is to keep the packing rings from molding into a solid bushing under gland pressure, and also to seal off any extreme clearance between the shaft and the bottom of the box and lantern ring. If the shaft has excessive run-out, the spacer rings will permit the packing rings to move laterally and seal effectively It is advisable, however, to refrain from using Teflon packing on any pump having run-out in excess of 0.002 in. This condition should be corrected before installing the pack-

Pure Teflon will work successfully in valves or other locations which require a static or semi-static seal. However, in oil refineries and some processing plants there are many applications where fire is a constant menace. The compounded Teffon packing can he used safely on such applications by filling the valve or pump three quarters full of packing rings and the re-mainder of the stuffing box with an

asbestos packing which would insulate and protect the Teflon in the event of fire. The compounded packing is resilient enough to absorb gland pressure through the asbestos rings, whereas pure Teffon would not.

For many years there has been a feeling against the use of graphite in the presence of stainless steel because of the possibility of electrolytic action and pitting of the shaft. Therefore, Teflon packing is being compounded in which the graphite is replaced with a friction reducer which will not cause electrolytic action or pitting.

PROPORTIONING PUMPS REGULATOR VALVES

Compounded Teffon packing is most serviceable in proportioning pumps because of its structure. It does not grip the rod and cause a heavy friction load which is common with most conventional type packings. This feature is advantageous because it precludes the possibility of packing drag affecting the function of the pump itself. Most conventional type packings eventually become hardened or badly worn due to the corrosive action of the product being handled and the excessive tightening required to effect a seal. This is also detrimental to the pumps' operation. One of the foremost manufacturers of proportionpumps has standardized on compounded Teflon packing after extensive tests in their plant and in the

The compounded packing is also widely used and well adapted to applications in regulator valves. A perfeet packing performance on a regulator valve demands that a packing operate successfully with a minimum friction load; excessive packing drag will not permit the valve to function With compounded Teflon packing the gland can be tightened only finger tight and the packing will still prevent leakage.

CENTRIFUGAL PUMPS: WATCH FIT AND RUN-IN

To pack a centrifugal chemical pump successfuly with conventional packing, it has always been necessary to give the utmost consideration to shaft alignment, and the shaft itself (Continued)

Atlas research announces



the superior acid and alkali proof cement
for joining brick and tile



This is the news you have waited for, ALKOR 5 E, the nearest thing to a universal corrosion-resistant cement. Check these properties: Inert to all solvents and alkalies; Resistant to all non-oxidizing acids; No appreciable shrinkage on setting; No obnoxious odors; Excellent workability; Easily tooled; Adhesion to wire cut brick greater than 500 psi; Tensile strength 1500 psi; Compressive strength 15,000 psi; Heat accelerates setting only, no fumes or smoke; Sets in less than 24 hrs. at 70° F. For complete information write us at 40 Walnut Street, Mertztown, Penna.



A COMPLETE LINE OF CORROSION-PROOF CONSTRUCTION MATERIALS



CORROSION FORUM, cont. . .

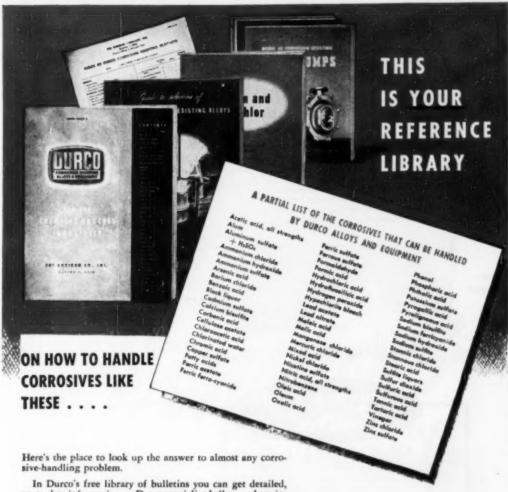
should be in good condition. Where possible, it should be hardened, ground and polished. This is particularly true when Teflon packing is being used. The user should remember that he is attempting to obtain a packing life many times greater than the life of conventional packing. The saving in shutdown time, production loss, shaft wear and general maintenance costs will more than compensate him for the trouble necessary to check the pump for alignment, and, if necessary, to equip it with a shaft in perfect condition. The eccentric or lateral motion should not exceed 0.001 in, for best results.

Nearly all chemical pumps come equipped with a lantern or seal cage. Where possible, a sealing fluid should be used. Under conditions which permit, the sealing fluid can be cold, clear water, which is preferable due to the low cost of operation and its desirability when used in conjunction with Teflon packing. When, due to the nature of the reaction, the use of water is not advisable, a suitable oil may be used in many cases.

In all centrifugal pumps it is necessary that a fluid film be present between the shaft and the packing. This film in some cases must be the product handled. However, in other cases it can be water or some other sealing fluid. In other words, in stuffing boxes on chemical pumps where chemical leakage is objectionable, the box should be set up with a fluid to provide the essential liquid mentioned above. This fluid must be introduced into the stuffing box in such a manner that it will surround the shaft and the packing.

In some cases neither water nor any other form of sealing fluid can be used. In this case it would be necessary to cool the stuffing box externally during the run-in period. This can be accomplished by running a stream of cold water on the stuffing

box and gland. Regardless of whether or not the stuffing box is equipped with a seal cage or lantern, it is necessary during the first half hour of operation to cool the gland and stuffing box externally. Teflon appears to have an exceptionally low coefficient of friction. At the same time, its low thermal conductivity retards the dispersion of frictional heat and its high coefficient of thermal expansion has the undesirable effect of reducing clearances as the temperature rises. Initial friction is always present when new packing is being run in. Many packings are caused to fail during the first half hour of operation because the pack-(Continued)



In Durco's free library of bulletins you can get detailed, up-to-date information on Durco specialized alloys and equipment. There are more than thirty bulletins available. Each bulletin is full of helpful technical information to guide you in the selection and application of Durco's products.

If you have anything to do with buying or specifying equipment to handle corrosives, you should have at least part of this reference library in your file. Listed below are some of the major bulletins and the Index which lists all Durco product bulletins. Just check what you want, and mail this page with your name, title and company address to Durco.

DURCO Adv. 110-GM

A Guide To The Selection Of Dyrco Corrosion Registing Alloys	THE DURIRON CO., INC.
Durimet 20	
Chlorimet 2 & 3 Bul. 114	DAYTON 1, OHIO
Seneral Catalog M Madel 40 Durcopumps Bul. 815	Branch Offices in Principal Cities
lelf-Priming Durcopumps Bul. 816	The second secon
iplit Flonged Pipe & Fittings	PHEND
khaust Fans Bul. 1103 ingle Valves Bul. 615	INIKM
ion-lubricated Plug Valves	Company of the Company
ubricated Flug Valves Bul. 636, 637, 638, 640	ALLOYS EQUIPMENT
feat Exchangers Bul 1610A ndex Of Durca Carrasian Resisting Products Form AD 158	The state of the s



material is odorless, tasteless and non-toxic. It will not cloud or break down in the presence of Corrosive chemicals . . . and has many properties which can not be matched by any other material. Ask for further details on your letterhead.

Chemical Resistance

SOLUTION dimensional weight SOLUTION dimensional weight 30° H, SO, none 0.08 tolurene none 0.78 30° H, SO, 0.00 tolurene none 0.78 10° NaCH 0.08 tolurene 0.76 notes 10° NaCH 0.08 tolurene 0.08 tolurene 0.08 10° NaCH 0.08 tolurene 0.08 tolurene 0.08 10° NaCH 0.00 tolurene 0.00 tolurene 0.00 10° NaCH 0.00 toluren			% CHANGE				% CHANGE	
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Test Method 7011, Federal Specification LP-406A.



oughton laboratories, inc. OLIAN MIN YORK



Corrosion Forum, cont. . .

ings were not allowed to run-in gradually.

Teflon packing will handle any corrosive product if the user will take the time and precaution to install it properly and break it in gradually, taking care to keep the stuffing box cool. If the packing appears to run warm, it would be well to stop the pump and permit it to cool down before starting up again. The packing will then take a permanent set providing an anular space around the shaft. After this point has been reached, external cooling will not be necessary.

In pump applications where the peripheral speed is low, such as on reciprocating pumps, the need for cooling during the run-in period is not as great. It should be watched, however, and if any undue temperatures rise occurs, the unit should be stopped and allowed to cool. Gencrally speaking, however, there need be no cause for concern in this type

of application.

AGITATORS, REACTORS, AND AUTOCLAVES

Here it is recommended that pure Teflon spacer rings to in. thick be used between compounded Teffon packing rings in identically the same manner as the installation recommended for centrifugal pumps.

The application on reactors is not usually difficult because the stuffing box is at the top of the unit. It is always well, however, to furnish the packing manufacturer with complete stuffing box dimensions because on some reactors the bottom of the stuffing box will require a slightly tapered ring to assure a perfect seal. These units should also be run in gradually so as to give the packing time to set properly.

Most autoclave applications include the use of a lantern or seal cage. In many cases, the lantern is sealed with a fluid at a pressure slightly in excess of the pressure in the vessel. Under these conditions, it is important that the set of packing be installed with spacers on each side of the lantern.

If a vessel is operated under a high vacuum, it is important that very accurate shaft and box dimensions be furnished the packing manufacturer so the packing rings and spacers can be molded to the exact dimensions.

Many users of chemical equipment have had some good results with chemical scals. When installing a seal, a great deal of care must be used, and, in some cases, actual alteration of the stuffing box and bearing frames must be made. If the users of Teflon

(Continued)

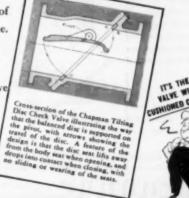


HOW MUCH DOES

Take just a moment to figure how much the slamming of ordinary check valves is costing you in extra maintenance. You'll find it's plenty!

Then switch to Chapman Tilting Disc Check Valves. You'll eliminate the slamming that causes those destructive pipe line stresses. Most of the wear on seats and hinges, too. And head losses will be almost 80% lower than for conventional type check valves.

Those features mean important savings. Yet there are many more. Write today for additional information.





The Chapman Valve Mfg. Co. INDIAN ORCHARD, MASSACHUSETTS

sulphuric acid?

 In many cases where high purity sulphuric acid is not necessary, tremendous savings can be realized through the use of an appropriate grade of spent acid.

An interesting additional advantage worthy of investigation is this: some products made with spent acid have better physical properties than those made with high-purity acid.

We handle hundreds of tons of spent acids every day. These acids vary widely from high quality to low acidity, and are priced in proportion.

Industries that require large tonnages of low cost acid should give careful thought to locating in the Gulf Coast area where this type of material is available in great quantity. Write to us for information concerning the strengths and grades of spent acid that are available. We shall be pleased to assist you.

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Have You Investigated the Possibility of Economy and Higher Quality of Product Through the Use of Demineralized

The Cochrane Demineralfantion Process delivers an elliuent equivalent to commercially distilled water or low cost of operation and of equipment. It has found wide application in the process industries where rigid requirements demand a high quality of water.

Water?

Write for details of this modern method of securing pure, mineral-free water, at low cost.



COCHRANE CORPORATION. 3113 N. 17th St., Philadelphia 32, Pa. In Canada: Canadian General Electric Company, Ltd., Toronto

In Mexico: Babcock & Wilcox de Mexico S.A., Mexico City

DEMINERALIZERS

CORROSION FORUM, cont. . .

packing would devote the same amount of time and care to the installation of packing, the results would be quite comparable to those of a successful seal. Teflon packing does require slightly more care in the installation and during the initial run-in than conventional packing, but it has been proved to the satisfaction of m...y users that the extra precaution more than pays for itself in the first few months of operation.

SOLID TEFLON GASKETS

Solid gaskets of Teflon were the first type to be used and are still the most important type. They are fabricated by die-cutting from Teflon sheet, by slicing from the end of a molded cylinder or by molding directly from powder.

They may be installed in flanges of standard design; raised face flanges are normally used for low pressures, 150 to 300 psi.: some confining arrangement such as tongue-and-groove or male-and-female is used for higher pressures. For example, solid gaskets of Teflon have been satisfactory in tongue-and-groove flanges at pressures as high as 30,000 psi.

In most physical properties, solid Teflon is equivalent to rubber-bonded compressed asbestos. Therefore, gaskets designed for the two materials are similar. The only important difference is that when a compression force is applied, the deformation of Teflon is greater. After compression is re-leased the two materials recover at practically the same rate. Both materials show a lack of resiliency. This sometimes presents a serious problem in applications where variations in temperature change the pressure on the gasket through expansion and contraction of the flanges and bolts. Spring loaded bolts are sometimes the best solution in such cases.

Orientation of Teflon exists only in sheet stock which, in the course of manufacture, is rolled and stretched. It has been found that orientation reduces the rate of deformation, but the rate soon becomes the same as in unoriented material. The only other deformation observed in gaskets cut from sheet stock is that it will shrink laterally when heated. However, this is not normally a factor in gasket use because the gasket is generally retained between flanges.

While Teflon is the answer to a great many packing problems, it is not expected that it will replace conventional type packings except where difficulties arise, mainly from corrosion. Its corrosion and heat resisting qualities make it ideal where conventional packings are short lived.—End

DON'T BE SATISFIED
WITH HALF-WAY MEASURES...

insist on <u>Walseal</u>® products and be certain



the FACTORY INSERTED Ring insures FULL PENETRATION of the Silver Alloy . . . a perfect joint

Today, contractors... builders... architects are using brazed connections, in ever increasing numbers on their brass and copper pipe runs. However, they must be certain that the correct brazing alloy is used; that the joint has penetration of alloy up the shoulder of the fitting.

That's why more and more are turning to Silbraz® joints made with Walseal valves, fittings and flanges which assure the proper amount of alloy with no waste. They know that the finished joint not only will withstand hydrostatic pressure, but it will also withstand terrific impact and vibration — in fact, no correctly made Silbraz joint has ever been known to creep or pull apart under any pressure,

shock, vibration or temperature which the pipe itself can withstand.

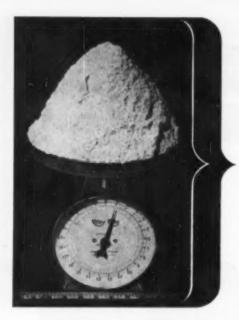
Furthermore, it is a relatively simple operation to make a Silbraz joint – no heavy scaffolding need be erected . . . just cut the pipe, flux, assemble, then braze, following the technique recommended by the Walworth Company. A silver brazing alloy – FACTORY INSERTED – in each port flows out when heated with the oxyacetylene torch, making a joint that is stronger than the pipe itself . . . a one-hand operation, with the mechanic out of the path of the deflected heat – at all times.

For full information about Silbras joints made with Walseal products, write for Circular 4-1.

WALWORTH

valves and fittings

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLE



LIGHT WEIGHT ... a useful and costsaving property of DICALITE MINERAL FILLERS

DICALITE MINERAL FILLERS are produced from diatomaceous silica. They are amorphous in character (not crystalline), comparatively soft and friable, and free from gritty matter. Following data give the range of properties of the many grades of Dicalite available for filler use.

Colors	gray white, buff, white
Refractive Inde	
Particle Size	from 10% retained on 150
	to trace on 325 mesh screen
Weight (loose)	8 to 13 lbs. cu. ft.
Surface Area	20,000 to 100,000 sq. ft. per lb.
Porosity	approximately 90%
Melting Point	approximately 2900° Fahr.

STRUCTURE-Diatom structure of the individual particles is responsible for many of the desirable filler properties of Dicalite. Instead of being approximately spherical, each par-ticle is irregular with a predominance of acicular and elongated shapes. Such particles form an interlacing "strawpile" pattern that reinforces and strengthens—an effect particularly noticeable in paint films, asphalt mixes, molded goods, etc.

LIGHT WEIGHT-This factor is often utilized to reduce shipping costs and for general bulking. The loose weight of Dicalite filler materials varies from 7 to 13 pounds per cubic foot according to grade. The apparent specific gravity is 0.112 to 0.21; actual specific gravity is 2.00 to 2.35.

VAST SURFACE AREA—Because of the diatom structure mentioned above, Dicalite fillers have a tremendous surface area per unit of weight. Each particle is irregular in shape and porous as well. This property is of decided benefit when the material is used as a source of silica, as a diluent for insecticides, as a carrier for catalysts, etc.

HEAT RESISTANCE—Dicalite materials have a melting point of approximately 2900° F. In addition, their high porosity makes them very poor conductors of heat. Thus, Dicalite not only improves heat resistance but reduces the heat conductivity of a material or product of which it is a part.

CHEMICAL INERTNESS-Composed of silicon dioxide (SiO₂), Dicalite filler materials are chemically inert, and can be used in compounding without special formulation in regard to reactions.

POROSITY AND ABSORPTIVENESS-Porosity or voids of Dicalite fillers will average 90%. Depending on the liquid and grade of material, absorptiveness will vary from 120% to 300% of the weight of the Dicalite. Wetability of all materials is excellent.

PARTICLE SIZE—Materials may be supplied for special purposes with virtually any particle size. The filler grades regularly supplied range as shown at the left. Predominating particle size of most grades is between 2 and 6 microns.

A Dicalite Engineer will be glad to discuss your specific application. Call or write any Dicalite office.

DICALITE DIVISION, GREAT LAKES CARBON CORPORATION

NEW YORK 17, N. Y. • CHICAGO 13, ILL. • LOS ANGELES 17, CALIF.

DICALITE MINERAL FILLERS

Names in the News



MAN OF THE MONTH

Lacrence H. Flett

"To the most routine and simple jobs, he always brought a fresh point of view, a speculation as to whether there might not be a new and better way of doing the old, old jobs and an enthusiastic program of investigation of what to most of us would seem merely old and dull stuff."
So said a long-time associate of Lawrence H. Flett, recently re-elected president of the American Institute of Chemists. To illustrate, the speaker compared him to the little girl who, when asked what they were doing in her cooking class, replied that right now they were "reviewing toast." To this spirit Mike Flett owes his large role in the development of the chemical engineering profession and the American dyestuffs industry.

The director of National Aniline's new products division, Allied Chemical & Dye Corp., began life March 26, 1896 in Melrose, Mass., where he received his early schooling. At M.I.T. he studied organic

chemistry and chemical engineering. He went to work in 1918 for the Marcus Hook, Pa., plant of National Aniline and Chemical Co., dyestuff manufacturers. With the return of German competition at that time, the American dyestuffs industry had to develop efficient commercial processes and useful organic chemicals. Mr. Flett started out to put the azo dyes on a sound basis. Revolutionary operating techniques introduced by him in those early years are still commercially practiced.

When the 1929 depression came there was available a line of products of better quality than had previously been imported. The company felt it was time to organize a group to expand the development of new products. Mr. Flett was put in charge. To their credit must go many dvestuffs, intermediates, and even an entirely new class of dyestuffs. One of Mr. Flett's greatest achievements was the development of the first commercial synthetic detergents prepared from petroleum. His product had a powerful washing ac-tion, was stable in hard water and in neutral or acid solutions and was a very efficient dispersing agent under all conditions of service. Some of the patents he holds in Canada, Germany, France, Switzerland, Argentina and the United States cover detergents of the higher alkylarylsulphonate type, applications of these detergents, dyestuffs and intermediates.

In recognition of his ability in industrial research and of his encouragement to the spirit of research in industry, the western New York section of the American Chemical Society awarded to him the Jacob F. Schoellkopf Medal in 1942.

Mr. Flett was assigned to his present post in New York in 1944. He and Mrs. Flett live in Scarsdale. He likes gardening and skiing; has the kind of sense of humor that makes him a first rate storyteller. dustrial Filter & Pump Mfg. Co. He was formerly a chemical project engineer with Publicker Industries, Inc.

John P. Remensnyder, president of Heyden Chemical Corp., New York, and Ralph N. Lulek and Simon Askin, both vice presidents and directors of that corporation, have joined the board of directors of American Potash & Chemical Corp.





J. J. Kerrigan

H. W. Johnstone

James J. Kerrigan has been elected president of Merck & Co., Rahway, N. J. He succeeds George W. Merck, who continues as chairman of the board. Henry W. Johnstone has been elected senior vice president.

William Kirk has retired from his post as assistant general manager of the organic chemicals department of E. I. du Pont de Nemours and Co., Wilmington. He has been succeeded by Samuel Leuber, formerly the department's director of manufacture.

Joseph J. Burbage, assistant laboratory director of Monsanto Chemical Co.'s Mound Laboratory at Miamisburg, Ohio, has been appointed executive director of atomic energy projects and assistant director in charge of administration at Monsanto's central research department in Dayton.

Walter Celmer and Philip N. Gordon have joined the research staff of Chas. Pfizer and Co., Brooklyn, N. Y.

Ambrose W. Staudt, manager of the market research section of E. I. du Pont de Nemours & Co.'s trade analysis division, has been transferred to the rayon department (Continued)

Carl S. Miner, director of Miner Laboratories, Chicago, has been selected to receive the 1950 Honor Scroll Award of the American Institute of Chemists, Chicago chapter. He is particularly known for his contributions to the manufacture of furfural, now used as a basic material for nylon. In 1949 he received the Perkin Medal of the Society of the Chemical Industry.

Robert C. Medl has joined the staff of the Quaker Chemical Products Corp., Conshohocken, Pa., as technical director. Previously, he was vice president and technical director of the McCormack-Medl Corp., Camden, N. J., manufacturers of surface coatings.

Ralph F. Hoeckelman of Battelle Memorial Institute has been awarded the Turner Book Prize for 1950 by the Electrochemical Society. The award is made each year for the best paper submitted by a young electrochemist.

Harvey N. Davis has retired as president of Stevens Institute of Technology, Hoboken, N. J.

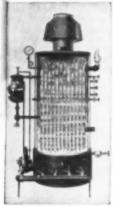
Barry Moyerman has been appointed district sales engineer in the Philadelphia-Baltimore area for the In-

Chemical Processing with CONTINUOUS MIXING ... This Bulletin Brings the Facts on New, High Speed Mixer

Write for free bulletin: ENTOLETER DIVISION, The Safety Car Heating & Lighting Co., Inc., 1197 Dixwell Ave., New Haven 4, Conn.

- **&** Complete Uniform Dispersion of Ingredients . . .
- Continuous or Batch Process . . .

WILL YOU HAVE Steam FOR PROCESSING THIS SUMMER?



The KANE Boiler is built to A.S.M.E. specifications, in sizes to 30 H.P.

Would you like to shut down your central steam system this summer? . . . there is still time to make some saving by doing so. Act now to insure an independent, dependable source of Summer Steam for your processes-we would suggest . . .

the Kane Boiler Package

Each KANE BOILER PACKAGE is carefully considered by us as an "individual" jab-from the customer's requirements to the finished unit. And each BOILER PACKAGE is a compact, self-contained steem source that includes: the correctly sized KANE Automatic Gas-Fired Boiler complete with gas burner and controls to maintain required steam pressure; and an M-K-O Automatic Boiler Feed System designed to return condensate and supply make-up water as required for highest operating efficiency.

Engineered Steam at its best with four decades of experience at your disposal-so, send your steam problem to us for study and recommendation.

ENGINEERED STEAM AT ITS BEST

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FOUR DECADES OF AUTOMATIC GAS-FIRED BOILER MANUFACTURING EXPERIENCE

Names in the News, cont. . .

where he will be engaged in market research studies.

John C. Cotner has been appointed president of the Hydraulic Press Mfg. Co., Mount Gilead, Ohio.

Walter Coopey has retired as engineering consultant, polychemicals department, Belle Works, E. I. du Pont de Nemours & Co., Charleston, W. Va.

Kent R. Van Horn has been made associate director of research for Aluminum Co. of America, New Kensington, Pa.







L. B. Pope

E. C. Fetter

Lester B. Pope has been made managing editor of Chemical Engineering. He succeeds Edmond C, Fetter who has resigned to join the public relations department of E. I. du Pont de Nemours & Co., Wilmington.

In addition to managerial duties Mr. Fetter has been in charge of rounding up specialists for, and conducting the "Corrosion Forum" department. He's a Lehigh graduate; was born in Hamilton, Ontario, and raised in Pennsylvania.

Les Pope has been associate editor in charge of copy. This means that it is largely through his efforts that our monthly quota of editorial wordage goes to the printer in readable form-or, at times, that it goes to the printer at all. He's also the man responsible for most of the reviews leading off our "Chemical Engineer's Bookshelf." He came to Chemical Engineering in 1939 via Columbia University and Scientific American where he was an associate editor.

Norman H. Collisson has been elected a vice president of Ecusta Paper Corp., Pisgah Forest, N. C.

Robert F. Marschner of the Standard Oil Co. (Indiana) has been elected chairman of the Chicago section of the American Chemical Society. With Standard Oil since 1934, Dr. Marschner's researches have been on the nature of hydrocarbons, catalysts in hydrocarbon conversions, mechanism of catalysis.

James I. Hoffman, chief of the surface chemistry section of the National (Continued)



Stumped.

BY YOUR CHEMICAL WASTE TREATMENT PROBLEM?

- ✓ Paper Mill Waste? ✓ Rayon Mill Waste?
- ✓ Steel Mill Waste? ✓ Refinery Waste?
- **✔**Plating Waste? **✔**Tannery Waste?

THAT CHEMICALLY TREAT A WIDE VARIETY
OF INDUSTRIAL WASTES

THE CYCLATOR® combines within a single basin ALL functions, both chemical and physical, for treatment of industrial wastes which contain large amounts of light suspended solids—or which upon treatment produce voluminess studges.

THE ACCELATOR 10 is adaptable to the treatment of many westes which land themselves to clarification by chemical treatment, by congulation and which produce relatively small studge volumes.

Over 50 years of experience and pioneering research in the field of water conditioning and waste treatment, plus the proof of efficiently working installations, are your assurance of a responsible answer to your waste treatment problem. Extensive facilities and a corps of highly trained Infilco experts are ready to lend you and your engineers valuable aid. Get all the details. Consult your telephone Red Book. Call in our nearest Field Engineer, or write us for Bulletin No. 70-A. There's no obligation.



ABOVE: CYCLATOR® of Bivar Boion Paper Co., Manroe, Michigan, for treatment of white water. BELOW: ACCELATOR® of Bock Island Befining Corp., Zonoville, Indiana, for treatment of waste water.

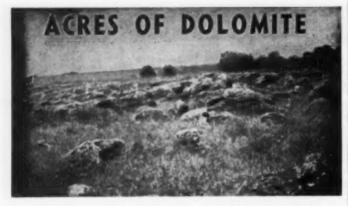


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INFILCO INC.

SALES OFFICES IN TWENTY SIX PRINCIPAL CITIES

WORLD'S LEADING MANUFACTURERS OF WATER CONDITIONING AND WASTE TREATING EQUIPMENT



Looming large in their potentialities for chemical utilization are Oklahoma's huge deposits of dolomite. In Murray County, in the Arbuckle Mountains, (south central part of the state) one deposit alone covers 1400 acres with a thickness of 550 feet. Its quality is very high.

Other deposits are available elsewhere in the Arbuckle Mountains, and in the Wichita Mountain area (near Lawton).

REPRESENTATIVE ANALYSIS OF OKLAHOMA HIGH-GRADE DOLOMITE

(Analysed by Oklahema Geological Servey)

ROYER DOLOMITE—MURRAY COUNTY
Representing 230 Foot Thickness

CeO		AI,O,	
N O	9.033	9,0, 8	0.010
\$10, Fe _. O _.		H ₂ O @ 103"	
-	otal oxides	100.034	

Detailed information on Oklahoma's mineral resources is available on request, based on data by the Oklahoma Geological Survey. Map showing location of mineral deposits is also available.





Names in the News, cont. . .

Bureau of Standards, has been elected president of the Chemical Society of Washington for 1951.

- Paul F. Preston has been appointed manufacturing manager of the General Electric Co.'s chemical department, Pittsfield, Mass. Prior to this, he was manufacturing and engineering manager of the department's chemical division.
- Sawyer F, Sylvester has been appointed assistant to the director in the textile chemicals department of Monsanto Chemical Co.'s Merrimac Division. He has been serving as the department's sales development manager.
- William M. Rand, president of the Monsanto Chemical Co., St. Lous, Mo., has been chosen to receive the Chemical Industry Medal for 1950. Mr. Rand, who is also president of the Manufacturing Chemists' Association, was elected to receive the medal by the executive committee of the American section of the Society of the Chemical Industry sitting as the committee of award.





W. M. Rand

C. L. Faust

- Charles L. Faust, head of electrochemical engineering research at Battelle Institute, Columbus, Ohio, has been named president of the Electrochemical Society. Dr. Faust has been a pioneer in the development of electropolishing. R. J. McKay, chemical engineer for the International Nickel Co., has been elected a vice president.
- Carl F. Schnuck has been appointed director of engineering for Farrel-Birmingham Co., Ansonia, Conn. Warren C. Whittum has been made chief engineer.
- A. S. Johnson has been appointed general manager of National Carbon Division of Union Carbide and Carbon Corp., New York.
- Llord J. Hughlett has joined the staff of Arthur D. Little, Inc., Cambridge, Mass. Formerly with (Continued)



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Graver Construction Service meets the engineering and erection requirements of all petroleum and process industries—on installation of new facilities... expansion or modernization of existing equipment ... maintenance and repair. Call us now!





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Engineering Dept.: Jersey City, N. J.

HOUSTON

A DIVISION OF GRAVER TANK & MFG. CO. INC. EAST CHICAGO, IND.

The <u>earlier M-C & S enters</u> your construction picture, the <u>more you benefit!</u>



Vast experience of

can save you much time and money!

To learn of new construction developments of which they can take advantage, many companies call in M-C & S for an early discussion of their building program. The result often has been a substantial saving for clients — in both time and money. The earlier you bring Merritt-Chapman & Scott into your construction picture, the sooner this broad experience is focused on your particular problem — whether it concerns a new plant, addition, or installation of new process equipment without work interruption. As illustrated by the new brochure offered below, no project is "out-of-our-line."



New booklet presents a factual record of M-C & S's ability to solve the most challenging construction problems.

Your copy will be sent immediately upon request to Dept. CE2.

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Founded in 1860 . . . now in our 90th year

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CLEVELAND . BOSTON . NEW LONDON

NAMES IN THE NEWS, CORT. . .

McGraw-Hill International Corp. as editor of Ingenieria Internacional Industria and Construccion, Mr. Hughlett will now be primarily engaged in studies leading to programs for regional economic development.

Harold A. Knight, formerly with the Journal of Metals in New York, and John F. Bohmfalk, Jr., formerly with the Office of Rubber Reserve, Washington, D. C., have been made associate editors in the New York office of Chemical and Engineering News and Industrial and Engineering Chemistry, ACS publications. Rodney N. Hader, formerly with Firestone Tire & Rubber Co., Pottstown, Pa., has been assigned to the society's Chicago office; William Q. Hull, formerly with the Houston Lighting & Power Co., has become associate editor in charge of the San Francisco regional office.





I. N. Welsh

T. H. Daughert

John N. Welsh has been named associate director of Hall Laboratories, Pittsburgh. He will continue as director of engineering service, a post he has held since 1939. Thomas H. Daugherty has been named director of research for Calgon, Inc., Pittsburgh, another associated firm in the Hagan Corp. group. Formerly assistant director of research, Dr. Daugherty will supervise development work in the application of the company's sodium phosphate glass.

Sylvan B. Lee, formerly assistant director of microbiological research and development for Merck & Co., has been appointed director of microbiological research of Commercial Solvents Corp. at its laboratories in Terre Haute, Ind.

A. Dexter Hinckley, executive secretary of the Illuminating Engineering Society, has been elected president of the Columbia University Engineering School Alumni Association.

Sam Norris has been elected president (Continued)

COPPER ALLOY BULLETIN

REPORTING NEWS AND TECHNICAL DEVELOPMENTS OF COPPER AND COPPER BASE ALLOYS

Prepared by Bridgeport Brase Company

Bridgeport"

Headquarters for BRASS, BRONZE, and COPPER

Effect of Higher Temperatures on Tube Life

In general, corrosion reactions are speeded up by a rise in temperature. Tests conducted in 3% sodium chloride solutions revealed that the depth of pitting doubles for each 20° C. rise in temperature in the range of 18° to 75° C. The effect of temperature on corrosion rate is influenced by the nature of the corrosion medium—water or other liquid, or gas—and the character of the metal or alloy in contact with this medium.

Why Warm Waters Are More Cerrosive

In sea water, a small rise in temperature often leads to a higher rate of corrosion, resulting primarily from greatly increased bacterial activity. With higher temperatures, organic decomposition is more active resulting in the generation of hydrogen sulphide and other odoriferous sulphur and nitrogenous compounds. The presence of even a trace of hydrogen sulphide accelerates the rate of impingement corrosion and changes the character of films of corrosion products.

Records clearly indicate that tube failures during warm seasons, in some localities, are far greater than those encountered during the winter. Condenser tubes installed during the summer often do not develop a satisfactory protective film and consequently may fail prematurely.

Protection By Scale Formation

In fresh waters, higher temperatures may be responsible for reducing the corrosion rate. With rise in temperature, certain waters precipitate minerals forming a brown or gray protective scale on the tube surfaces in water heaters, exchangers and evaporators. The scale, essentially of calcium carbonate or silicate, may become quite thick

Evaporation of sea water and fresh waters may lead to concentration of mineral matter to a point where precipitation of thick mineral scales occurs which may build up at rates as high as 0.0625" per month or even higher depending upon the size of coil and amount of water being evaporated. Unfortunately, excessively thick mineral scales interfere with heat transfer properties and must be removed.

Hot Wall Effect

Sometimes severe local corrosion or pitting can rapidly perforate heat exchange tubing on the water or liquid side. Air bubbles or debris separating from the water cling to the metal

surface at certain points and act as heat insulators thus allowing small areas to become hotter locally. approaching the temperature of the hot liquid or gas on the other side of the tube wall. Corrosion at these points proceeds at a rate corresponding with this higher temperature. This accelerated corrosion rate is not encountered where the tube surfaces are kept smooth and clean.

Suggested preventive measures are: Lower operating temperatures.

Clean tubes immediately when water carries in much debris, mud, silt, rust, etc.

Increase water velocity to help dislodge debris and bubbles of gas.

Feed Water Heaters

Because of the less corrosive nature of the water and the small amount of mineral matter, serious scale formation or deposits are not generally formed in feed water heater tubes. The chief effect of the higher temperature is to lower the physical properties of the metal and increase the creep rate. Higher pressures and temperatures can be handled by tubing with heavier wall thicknesses designed for such service. Cupro Nickel (70-30), because of its low creep rate at higher temperatures, is popular for use in feed water heaters which operate between 500*-600* F.

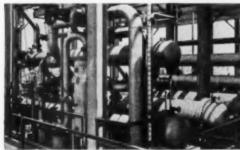
Performance Records Important

We find that more and more engineers in oil refineries and power plants are keeping careful records of tube life on each condenser and heat exchanger in their plants. Often special units are operated with experimental tubing and piped so that they can be by-passed in order to study the effects of corrosion.

If tubes fail prematurely then studies are immediately started to determine whether the correct alloy has been selected or whether changes in the operating procedures must be made.

Whereas the Admiralty alloy was formerly standard for practically all oil refineries, many are now using Aluminum Brass, Aluminum Bronze or Cupro Nickel, especially if the plants are located on the sesboard where corrosion is excessive.

Engineers who need help on their tube problems can call on Bridgeport's corrosion laboratory. Much information can also be found in Bridgeport's "Condenser Tube Manual" and "Duplex Tubing Technical Bulletin No. 1950", available upon request made on company stationery.



Reactivator and miner condensers and gas intercooler, courtesy Tide Water
Associated Oil Company, Bayonne, N. J.

BRIDGEPORT BRASS

REDGEPORT BRASS COMPANY, BRIDGEPORT 2, CONN. .

Mills at Bridgeport, Connecticut, and Indianopolis, Indiana . In Casada: Norundo Capper and Bri

ESTABLISHED 1848

For GREATEST DEPENDABILITY and EFFICIENCY in metered pressure pumping of

SULPHURIC ACID

... at all concentrations

Here is the equipment which will handle sulphuric acid, in all concentrations, performing the dual function of taking the acid from atmosphere pressure to line pressure, and metering or proportioning its flow. Because the Pulsafeeder has no stuffing box—but uses instead an hydraulically-balanced diaphragm seal, it eliminates leakage, prevents corrosion of pump or contamination of product, avoids loss of prime—all at lowest possible maintenance. Hundreds of satfactory installations to back up these claims!

- . NO STUFFING BOX OR RUNNING STAL
- . HYDRAULICALLY-BALANCED DIAPHRAGM SEAL
- . POSITIVE DISPLACEMENT PISTON MEASUREMENT
- . FLOW RATE ADJUSTABLE WHILE IN OPERATION
- . OIL-BATH LUBRICATION OF ALL MOVING PARTS
 - FOR MANUAL OR

FOR MANUAL OR AUTOMATIC CONTROL

Lapp PULSAFEEDER

WRITE for Bulletin 262 with complete description and specifications.

LAPP INSULATER CR., INC., PROCESS CRUIPMENT DIVISION, 206 MAPLE STREET, LE BOY, N. T.

NAMES IN THE NEWS. CORT. . .

of Amperex Electronic Corp., Brooklyn, N. Y.

Robert T. Wood has been named chief metallurgist of magnesium products for Aluminum Co. of America, Pittsburgh, Pa.

Monte C. Throdabl has been appointed research supervisor in rubber chemicals for Monsanto Chemical Co.'s rubber service department. Paul M. Downey and Marion Harman have been appointed group leaders.

George M. Powell, technical head, vinyl coatings research, Union Carbide and Carbon Corp., South Charlestown, W. Va., has been presented with the John Wesley Hyatt Award for distinguished achievement in plastics. Mr. Powell was honored for his work in planning and directing the development, formulation and application of Vinylite dispersion resins.





G. M. Powell

F. D. Rossini

Frederick D. Rossini, formerly chief of the thermochemistry and hydrocarbons section of the National Bureau of Standards, has been named to receive the Department of Commerce Exceptional Service Award for his contribution to the field of hydrocarbon research. His work has been an important factor in the development of processes for getting more gasoline from a given amount of petroleum and for producing high octane fuels. He has just been appointed head of the chemistry department of Carnegie Institute of Technology. He holds a new professorship in chemistry established through a grant by the Gulf Oil Corp.

John Ray Dunning, professor of physics scientific director of Columbia's new cyclotron at Irvington-on-Hudson, N. Y., and a pioneer in atomic research, has been appointed dean of the school of engineering at Columbia.

Merton B. Lilly has been appointed (Continued)



The Lummus construction superintendent and field engineer averages a twelve-year record of refinery building, literally-"everywhere under the sun." In addition, he has seen service at chemical plants and other heavy construction both in this country and abroad.

In a period of rapid progress, he has contributed to new techniques: the pre-assembly of pipe and equipment before erection, the raising of heavy vessels to greater heights and the providing of means to facilitate future maintenance and "turn around." Refinements in the scheduling of the erecting sequence are an outgrowth of his experience.

Behind Lummus' "ahead of time" deliveries stands the Construction Man. Because he has learned to anticipate the problems of remote location, emergencies seldom arise. But the records show that his decisions, made on-the-spot to meet the unexpected, reveal sound judgement and a steady hand. The low labor turnover, reflecting the high morale of his crews, both American and native, is evidence of his human as well as his technical understanding.

During the war he constructed, in record-breaking time, ordnance plants, high octane gasoline plants and plants that produced the raw materials for synthetic rubber. Today, the Lummus Construction Man is combining time savings with dol-

lar savings in new projects throughout the world.

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NAMES IN THE NEWS, CORE . . .

head of the patent department of Wyandotte Chemical Corp., Wyandotte, Mich.

Murray Senkus has been appointed director of research and development for Nox-Rust Chemical Corp. He was formerly a group leader in the research department of Commercial Solvents Corp., Terre Haute, Ind.





E. H. Northey

J. T. Thurston

Elmore H. Northey has been made assistant to the vice president in charge of research and development of American Cvanamid Co., New York. He received his undergraduate and graduate training in organic chemistry at the University of Minnesota. He joined the Calco Chemical Division in 1932 and was assistant director of research in charge of research and development on pharmaceuticals when he was transferred to Stamford. Jack T. Thurston has been appointed administrative director of the Stamford Research Laboratories, Stamford, Conn. Joseph H. Paden has been made director of the research division of the laboratories.

- M. A. Williamson, formerly a vice president of McGraw-Hill Publishing Co. and publisher of Chemical Engineering and Food Industries, has joined Van Diver & Crowe, Inc., New York advertising agency, as vice president. Mr. Williamson will be responsible for the development of new agency clients particularly among companies having both industrial and consumer problems.
- E. Leon Foreman has been made research director in charge of all laboratories and new product development for Special Milk Products, Inc., Los Angeles.
- E. H. Wright has been named chairman of Engineering Institute of Canada, Edmonton.

William J. Halev has been elected president of Esso Export Corp. Harold W. Fisher has been ap-(Continued)

OLIVER PRECOAT FILTER

Solves an Unusual Filtration Problem!



- The operator is a manufacturer of automobile bumpers.
- The solution handled is a sulphuric acid "brightener" bath following the nickel plating operation in an automatic plating system.
- The problem was to remove continuously the solids formed by chemical reaction during this "brightening" operation, solids difficult to filter because they tend quickly to blind a cloth. These solids, if permitted to remain, would result in faulty finishing which in time would cause pitting and rusting.

Principle of Precoat Operation

(Lead Protected)

Here's how the Oliver Precoat Filter handles this situation: as the drum, precoated with about 2 inches of diatomaceous earth, revolves in the vat a thin film of solids is deposited on the surface. This film is carried around to the discharge point where it is shaved off by a knife edge traveling in toward the drum at a very slow rate. The cleaned surface of precoat enters the tank for further cake deposition. The key to the success of this operation is that the film is removed continuously and not allowed to build up to a point

where it slows down filtration. The precoat layer lasts several days. It takes about two hours to replace the precoat.

At this plant, the Oliver Precoat Filter is keeping the solids content down to 0.062% which is well within safe limits.

Here is an excellent example of the value of the wide selectivity in filter types provided by the Oliver United line. There are many other types, each with its special advantage. But for this problem, the Precoat proved best.

With many filter types available plus more than forty years of filtration experience, wouldn't it be logical to bring your filtration problem to Oliver United?

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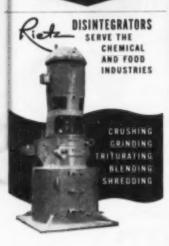
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- . 1800 & 3600 RPM

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NAMES IN THE NEWS, COUR. . .

pointed to succeed him as coordinator of the refining operations of Standard Oil Co. (New Jersey).

- John T. Byrne has been chosen as the second recipient of the \$2,500 Merck Graduate Fellowship in Analytical Chemistry, administered by the American Chemical Society.
- F. S. Mallette has been made assistant director of research, air and stream pollution control, for the American Steel and Wire Co.
- E. H. Bohle, manager of the commercial research division of the Jefferson Chemical Co., New York, has been elected president of the Chemical Market Research Association, Other officers elected were vice president, R. M. Prather, Merck & Co., Rahway, N. J.; treasurer, J. D. McPherson, American Cyanamid; recording secretary, Paul Weller, Wyandotte Chemicals Corp.; corresponding secretary, Fritz Von Bergen, Westvaco Chemical division of Food Machinery & Chemical Corp.





E. H. Bohle

R. Calvert

Robert Calvert, chemist and patent attorney, has been elected president of the Technical Societies Council of New York, Inc. Paul T. Onderdonk has been elected vice president; Richard F. Warren, market editor of Chemical Engineering, has been made secretary and T. R. Leadbeater, treasurer.

Melvin L. Bunting has been appointed technical service engineer for Acheson Colloids Corp., Port Huron, Mich. His former position was with the production and quality control department of the U.S. Gypsum Co., Detroit.

Lawrence J. Finnun, Jr., has been appointed director of purchases for Hercules Powder Co., Wilmington, Del.

W. A. Lutsch has been made manager of branch office operations in Detroit and the state of Michigan for Dearborn Chemical Co., Chicago. (Continued)



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STAINLESS STEEL FLANGES
Up To and Including 2" I.P.S.
Machined from Drop Forgings
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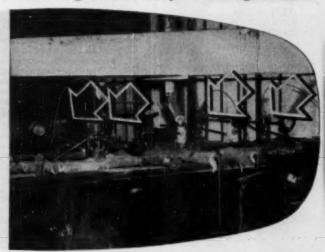
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production...efficiency...product quality

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Sylphon Temperature Regulator 923-typical of the complete Sylphon line. Available with dial indicating thermometer. Can be supplied with fin type bulb for

Controlling temperature of pigment drying in a large ink factory. Sylphon Regulators shown have given over 30 years of trouble-free service.

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NAMES IN THE NEWS, CORT. . .

William Jamieson has been named vice president of industrial sales and Lewis Blackhill as assistant vice president of Dearborn Chemical Co. (Toronto).

- Charles L. Haslup has been appointed sales manager of the R-P&C valve division of American Chain & Cable Co., with headquarters at Reading,
- J. R. Keach, general manager of Quaker Rubber Corp., Philadelphia, has been elected a director and vice president of the company.
- E. N. Rosenquist has been appointed assistant director of the central re-search department of Monsanto Chemical Co.
- Arthur H. Martin has been appointed president of Chemical Develop-ments of Canada Ltd., Ottawa. Newly appointed vice presidents are Carey R. Wagner and Douglas S. Calder.

OBITUARIES

David M. Goodrich, 74, recently re-tired chairman of the board of B. F. Goodrich Co., died in his home in Mt. Kisco, N. Y., May 17.

Charles S. Northen, 81, food chemist, died at Ocala, Fla., May 18.

Edward B. Hevden, 52, head of Graver Construction Co., and vice president of Garver Tank & Mfg. Co., died in his home in Cranford, N. J., April 18.

Edward F. Everett, 35, chemical engineer with Houdry Process Corp., Philadelphia, died May 24.

Willis F. Washburn, 64, who played a major role in the improvement in the manufacture of titanium pigments, died at Waterville, Maine, May 24.

Ralph Prater, 53, president of Prater Pulverizer Co., Chicago, died in Van Nuys, Calif., May 25.

A. H. Winheim, president of Planetary Chemical Co., St. Louis, Mo., died in an automobile accident June 3.

Thomas S. Hammond, 56, chairman of the board, Whiting Corp., Harvey, Ill., died in Chicago on June 15



A HALF CENTURY OF CHEMICAL **PROGRESS**

Exhibitors at the National Chemical Exposition will show-

Chemicals-raw materials, intermediates, specialties Equipment and Apparatus Ideas and Development

Features

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Attendance

Over 40,000 chemists, chemical engineers, executives, purchasing agents and others who will be interested in your services. The 118th National meeting of the ACS will also be held in Chicago September 3-8, 1950

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Quick Change

... of filter plates in SPARKLER FILTERS

means no shut-down for cleaning . . . The entire horizontal filter plate assembly in Sparkler Filters can be removed as a complete unit and a new assembly lowered into the filter in a few minutes without appreciable interruption in service. This quick change of plates is an exclusive Sparkler feature. No other filter has this unit assembly of plates for fast handling.

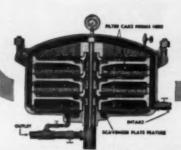
Another distinctive Sparkler feature is the firm, even support of the filter cake provided by the horizontal position of the plates. The filter cake will not crack or slip under variation in pressures or with intermittent operation of the filter. Any type of filter paper, cloth, screen, or filter media can be used

without danger of breaking. There is no supporting strain on these materials.

Sparkler filters take up little floor space, are completely enclosed, and are available in stainless steel, mild steel, rubber lined, steam or brine jacketed, monel, nickel, or bronze. They are capable of efficiently handling practically any kind of liquid from thin alcohols to varnishes and resins.

Sparkler service includes laboratory test runs and engineering of continuous flow filtration for production line installations. Write, giving details of your filtering





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OTHERS WO SUBMERGED OHLESS . OPERATE DRY or SUBMERGED IN DYES, PLATING, CLEANING & CHEMICAL SOLUTIONS, GASOLINE, POODSTUFFS TRULY OILLESS AND SELF-LUBRICATING EXTREMELY DURABLE CONSTANT COEFFICIENT OF FRICTION . APPLICABLE OVER A WIDE TEMPERATURE RANGE even where all solidifies or EXTENSIVELY USED IN CON-ROTATING SEALS OF UNEXCELLED GRAPHITE METALLIZING

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INDUSTRIAL NOTES

NEW FACILITIES

Nicholas Engineering & Research Corp., New York-A spray dryer division to coordinate its engineering and research with those of A/S Niro Atomizer, Copenhagen, Denmark. Except for the atomizers, all parts of the dryers are manufactured in the United States.

R. S. Aries & Associates, New York-A department to handle process evaluation, economic surveys, pilot plant tests and plant design for hard and soft wallboards.

Chicago Steel Service Co., Chicago-An office and warehouse at 45th St. and Kildare Ave., Chicago, to be completed late this fall.

DeVilbiss Co., Toledo-A plant in Somerset, Pa. When completed, it will increase the company's output of air compressor outfits, spray painting equipment, atomizers.

A. O. Smith Corp., Milwaukee-Electric motor manufacturing facilities

in the east through the purchase of Whirl-A-Way Motors, Inc., Tipp City, Ohio.

Abbott Laboratories, North Chicago, Ill.-A Philadelphia branch headed by Charles Moyer.

Eastman Kodak Co., Rochester, N. Y. -A wholesale branch in Dallas, Tex., to serve Texas and the South-

Owens-Illinois Glass Co., Toledo-An Oklahoma City branch for its Kaylo Division. The company has also reestablished its Atlanta branch and transferred its Dallas branch to Houston.

Pennsylvania Salt Mfg. Co., Philadelphia-A district sales office in Detroit to serve Detroit and southern Michigan. Harry G. Potts, district sales manager of the heavy chemicals department, will be in charge. The company's former sales office at its Wyandotte, Mich., plant has been discontinued.

(Continued)



ZENITH ADVANTAGES uniform consistency.

Closed construction
Easily installed
Minimum floor space
Good plant housekeeping tous of wet pulp per hour.

Model ZP . . . our smallest press with less capacity than the ZM or ZL but having a very high efficiency.

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Widen the work range of your machines with <u>REEVES</u> Variable Speed Control

It's easy enough to get a machine, to do one "trick." But when that machine is called upon to handle one material, size or shape today and another tomorrow—that's just

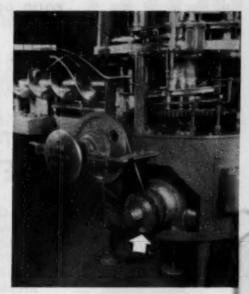
asking too much of a one-speed machine!

What that machine needs is REEVES Variable Speed Control—to make it more versatile, more adaptable, immediately responsive to every changing condition. Then its work range is increased, it turns out more work, more kinds of work, better work. An operator will always use the right speed because he can secure it so easily. He simply turns a handwheel or pushes a button.

If any machines in your plant are limited by fixed speeds—which require changing belts and pulleys for every change of product or process—investigate REEVES Speed Control. The cost will likely be far less than you expect; results will be immediate and continuous.

Only Reeves builds a complete line of speed control equipment—built around three basic units—to insure the correct installation for your special requirements. Write for copy of most comprehensive book on speed control ever published, Catalog CE43-3N.





Vari-Speed Jr. Permits Filler to Handle a Wide Range of Varying Product Consistencies

This Utility Filler, used in the Food and Chemical Industries, is standardly equipped with a No. 860 REEVES Vari-Speed Jr. When required by the application, a sprocket is also supplied to provide a direct drive from the closing machine used in conjunction with the Filler.

The 1½ hp motor is mounted on a special pivoting base the position of which is controlled by a crank located be neath the motor. With REEVES on the job, capacity of the Filler can be varied from 30 to 75 containers per minute Filler may be operated at varying speeds to compensate for changes in consistency of different products being filled.

This is but one of thousands of applications on record in which REEVES Speed Control widens the work range of machines—lowers the cost of doing business. See the listing below for other money-saving functions performed by REEVES.

REEVES PULLEY COMPANY, COLUMBUS, IND.

Recognized Leader in the Specialized Field of Speed Control Engineering



Other Usesi

Hendle more shapes, sizes and materials. Match skills of operators. Compensate for changes in character of product in process.

Maintain uniform peripheral speeds. Maintain uniform pressure, temperature, liquid level, atc. Regulate conveyor speeds. Synchronize ports of one machine or different machines operating in series.

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PROMOTE YOUR PROFITS



SPROUT-WALDRON
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RODENT POISONS
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The modern trend to pelleting is making great strides in the processing industries. Day after day, Sprout-Waldron's engineers are called upon to make recommendations on pelleting a great variety of products.

Pelleted products are easier to handle, easier to merchandise, easier to sell. They have less competition, bring a higher price—step up profits.

Pioneers in pelleting, Sprout-Waldron have the experience, know-how, and facilities to supply you with the finest pelleting equipment, engineered to your individual needs.

Consult with a S/W processing expert, or write today for the New Simplex Bulletin to Sprout, Waldron & Co., Inc., 15 Waldron Street, Muncy, Penna.

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SproutWaldron

Size Reduction . Mixing and Blending

Bulk Materials Handling . Product Classification . Pelleting and Special Facilities

INDUSTRIAL NOTES, cont. . .

Norcross Corp., Newton, Mass. — A sales and service office in Jersey City, N. J., to serve the New York territory. In charge will be George Apfel.

I-T-E Circuit Breaker Co., Philadelphia—A separate small circuit breaker division, to afford more flexible and complete service. Frederick G. Schmidt, who has been assistant to the president, has been appointed manager.

NEW LOCATIONS

United States Rubber Co., New York, has transferred its sales and technical service headquarters for vinyl resins to Naugatuck, Conn.

McDonnell & Miller, Inc. has moved its home offices into a new building at 3500 North Spaulding Ave., Chicago. The company manufactures boiler water level controls and other safety devices for steam and hot water boilers.

Chicago Bridge & Iron Co. has moved its San Francisco branch office to 200 Bush St.

R. S. Aries & Associates has moved its executive offices to 400 Madison Ave., New York. General engineering and drafting offices remain at 26 Court St., Brooklyn, N. Y.

Sylvania Electric Products Inc. has consolidated its New York offices in a new headquarters at 1740 Broadway.

Interchemical Corp. has moved its Fair Lawn headquarters to Have thorne, N. J.

Orelite Products Corp. has moved its office, laboratory and factory to Lodi, N. J.

Filtrol Corp. has moved its new national headquarters to 727 West 7th St., Los Angeles. The company produces chemically treated materials.

NEW COMPANIES

Laclede Arch Co., Chicago, to handle industrial furnace enclosures. It is a division of Laclede-Christy Co., St. Lonis. Walter W. Shipley, formerly vice president of the parent company, has been made president.

Jerguson Tress Gage & Valve Co., Ltd., London, England, to mer-(Continued)

137

THE PUREST CAUSTICS ARE MADE IN NICKEL EQUIPMENT

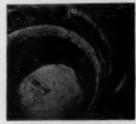
Let that fact help you fight caustic corrosion in your plant!



Hickel tank and agitator used in production of magnesium hydroxide.



Flaker and breaker used to convert molten sodium hydroxide to flake coustic. All surfaces exposed to coustic are Nickel, except Ni-Resist® cooling drum.



Scap-boiling kettle, 11 feet in diameter, 21 feet deep. Fabricated from 10% Nicklel-Clad Steel.



Monel® trimmed valve for handling coustics in petroleum refinery. Monel is a high Nickel allay.



Mickel-Clad Steel tank car for transporting the iren-free liquid coustic needed by rayon, soap and film industries.

Yes, the purest caustics are made ... stored ... and transported in Nickel equipment.

So what better recommendation could you follow when selecting plant equipment to withstand the corrosive attack of caustic alkalies?

In Nickel you have a metal that has repeatedly proved its ability to resist corrosion and guard product purity.

Nickel offers an unusual combination of properties...corrosion resistance, strength, high heat conductivity and ease of fabrication.

Nickel comes in all forms . . . standard mill shapes, pipes, tubing, sheet, fittings, wire and woven wire cloth.

And, where you need extra thick sections for large pieces of equipment, you can use Lukens Nickel-Clad Steel at a saving over solid Nickel plate.

If you have any problem involving corrosion control, pass it on to Inco.

We have the men and the metals to help you. Write for a Corrosion Data Work

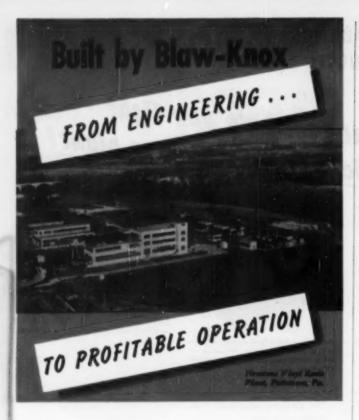
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NICKEL

for economy for safety



THE INTERNATIONAL NICKEL COMPANY, INC.
47 Well Street, New York 5, N.Y.



"TURN-KEY PROJECT"—a plant designed and built from the ground up and turned over to the owners ready to operate...this describes the vinyl resin plant built for Firestone Tire & Rubber Co. Tests were run in the owner's pilot plant with both Firestone and Blaw-Knox engineers cooperating. Blaw-Knox developed the plans, constructed the complete plant, and turned it over to the owners ready for use.

Chemical Plants Division is engaged constantly in designing and building "turn-key projects" in many industrial fields.



INDUSTRIAL NOTES, cont. . .

chandise and service on a worldwide basis the gages and valves of Jerguson Gage & Valve Co., Somerville, Mass.

Caldwell Chemical Co., New York, to sell and distribute industrial chemicals. A branch office has been set up in Detroit.

Industrial Nucleonics Corp., Columbus, Ohio, to manufacture and deal in instruments, gages, meters, counters, machinery and appliances used in the chemical fields.

Mathieson Hydrocarbon Chemical
Corp. to produce a number of chemicals from hydrocarbons contained
in the natural gas stream transported by the Tennessee Gas Transmission Co. over its pipeline network from Texas and Louisiana to
the northern and eastern markets.
The company has just been organized as a joint venture of Mathieson
Chemical Corp. and Tennessee Gas.

Stainless Products Corp., New York, to market tanks of stainless steel and allied metals on a world-wide basis.

NEW NAMES

Vulcan Proofing Co., Brooklyn, N. Y., has changed its name to Vulcan Rubber Products, Inc.

Albert & Davidson Pipe Corp., Brooklyn, N. Y., jobbers in iron and steel pipe, valves and fittings, has changed its name to Davidson Pipe Co.

Dryomatic Corp. of America, manufacturers of dehumidifying units, has changed its name to Dryomatic Corp. Reorganized as a Virginia corporation, it has moved its plant and main offices from Baltimore, Md., to Alexandria, Va.

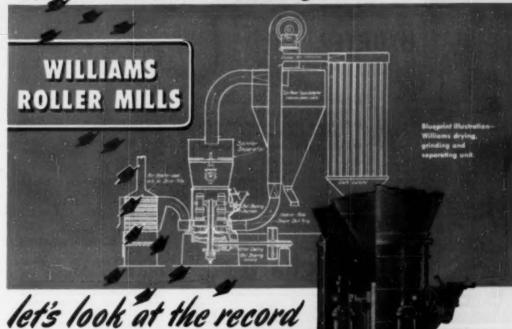
Hapman Conveyors, Inc., and C. H. Dutton Co. have changed their name to Hapman-Dutton Co. It will be composed of the Hapman Conveyors Division, Detroit, and Dutton Boiler Division, Kalamazoo, Mich.

NEW LINES

Aluminum Co. of America has assumed the magnesium fabricating activities of its subsidiary, American Magnesium Corp., Cleveland, which has become inactive. Operations will continue at Cleveland.

(Continued)

For those Fine Grinding Jobs . . .



PYRETHRUM AND OTHER FIBROUS INSECTICIDES

The Williams Roller Mill has given excellent results in the grinding of various rotenone bearing insecticides as it pulverises the fibres to the same uniform fineness as the rest of the plant. Pyrethrum flowers can be pulverised to 98.5% passing 200 mesh. Also grinds D.D.T., Sodium Fluoride, etc.

PAINTS, PIGMENTS, DRY COLORS

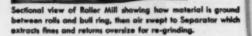
Williams Roller Mills are establishing remarkable records in the grinding of pigments and dry colors to successes of 99.95% 325 mesh and successes. Fineness instantly changed by varying speed of Spinner Separator Blades.

FINE GRANULATIONS

Williams has developed a special type of impact pulverizer to operate in connection with the air separator for the making of fine granulations of 30 to 80 mesh with a minimum of fines.

BARYTES, PHOSPHATE, LIMESTONE

Almost any mineral can be economically pulverized with the Williams Roller Mill. Finenesses quickly changeable from 40 mesh to 400 mesh. All can be dried and ground simultaneously by introduction of hot air.



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Heavy-duty hommermills; impact and railer mills for 200 to 325 mesh grinding; drier mills; air separators; vibrating screens; steel bins; complete "packaged" crushing and grinding plants.

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- Only Service Connections Required

Prischard HYDRYERS are unexcelled for efficiency and dependability in drying air for instrument and process controls. Standard packaged units are designed to reduce dew points of compressed air and other gases to minus (—) 40° F. No special installation required. Specially designed units may be built to your requirements.

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EQUIPMENT DIVISION 908 Grand Ave., Kansas City 6, Me. QUALITY District Offices: EQUIPMENT Chicago . Houston . New York . Pittsburgh . Tulsa . St. Louis Other Representatives in Principal Cities from Coast to Coast OR CABL veyer problem at this pattery plant was best solved by Hapman Conveyors. Seven® kinds of coramic raw materials are han without intermixing. They are measure to hopper in lower on 2 planes up 2 floors into Blunger room, Positive-discharge Hopman rotery velves insure accurate valu-metric discharge into any one of the 6 Biungers. Plate small wall and CONVEYING the minimum sup alls and keep segregated 7 types of moterial. The conveyor must be dust-tight and operate in more than one plane and direction without transfer points. There is only limited space clearance and supports. Only Hapmon Rubbor-Flight Chain Conveyor is able to meet all these DIFFICULT requirements at the budgeted cast. When confronted with difficult conveying problems, you'll probabily find the answer in Hepman Conveyors. They are handling most types of flowable materials under one or more of the 45 difficult conditions which only completely "job-engineered" Hapon Conveyors meet successfully. Send for the Hapman catalog showing those materials and the methods used to handle them. HAPMAN CONVEYORS, Div. STANSON HAPMAN-DUTTON COMPANY

INDUSTRIAL NOTES, cont. . .

Pettibone Mulliken Corp., Chicago, has acquired a complete line of hammermills and feed mills, since making Hammermills, Inc., St. Louis a wholly owned subsidiary.

Watertown Mfg. Co., Watertown, Conn., has gone into the powdered metallurgy held. It has acquired the physical assets of the Moulded Metals Co., Watertown.

Babcock & Wilcox Tube Co. plans to enter the field of limited fabrication of seamless and welded tubing. Types of fabrication will include bending, end forming, flash-butt welding.

Pennsylvania Crusher Co., Philadelphia, has acquired a line of hammer mills through the purchase of Dixie Machinery Mfg. Co., St. Louis.

NEW REPRESENTATIVES

Cyclotherm Corp. has appointed Flagg, Brackett & Durgin, Inc., Boston, to distribute its packaged type steam generators in New England. Phillips Engineering Co., Detroit, has been appointed for Michigan; Bingham and Risdom Co., Green Bay, Wis., for Wisconsin.

Chicago Eye Shield Co. has appointed Guardian Safety Equipment Co., Birmingham, Ala., its distributors for Alabama and Mississippi.

De Laval Steam Turbine Co., Trenton, N. J., has appointed Wilkinson & McClean, Ltd. of Calgary, Alberta, Canada, as sales representative for that province.

Ampco Metal, Inc., Milwaukee, has appointed Jaeger Welding Supply, Inc., Springfield, Mass., and Texas Welding Supply Co., Dallas, as franchised distributors in their respective areas.

Pulva Corp., Perth Amboy, N. J., has appointed Williams Sales Co., Cincinnati, Ohio, its exclusive representative covering Ohio, Michigan, Kentucky, West Virginia and Western Pennsylvania.

Blackmer Pump Co. has appointed the following distributors: Blott-Robb Co., Transmission Machinery Co., Ameo Corp., Chicago: H. O. Link Co., Baltimore: Tri-State Equipment Co., Kansas City: Avels Sales and Engineering Co., Indianapolis.

News about UNICHROME TINGS for META









How 3 plants have CONTROLLED CORROSION

by applying systems of TOUGH, CHEMICAL-RESISTING COATINGS

Here's more evidence to show that the system of coatings with the right degree of chemical resistance gives outstanding results even under severest service conditions.

1. LARGE NORTH CENTRAL PRODUCER OF CHEMICALS has used Ucilon Coatings extensively on structural work and equipment. Applied to interiors of brine tanks, Ucilon Coating System is still in excellent condition after more than 5 years.

IN WELL KNOWN CORN PRODUCTS RE-FINERY, the Ucilon Coating System used was in tip-top condition after a year on alloyed steel tanks, which, when left unprotected, had been badly etched in weeks-despite the special steel.

3. IN TEXTILE PROCESSING PLANT, Ucilon Coating System was applied to dye-house salt machine. Two years later, the protective system was still intact. Maintenance man reported Ucilon Coatings were the only ones that were successful, others being broken down within weeks by the wet salt.

You'll find many Ucilon Coating Systems ready to give service-proved protection against this broad group of chemicals: Acids, alkalies, salt solutions, petroleum and its derivatives, water, oxidants. Coating systems have been engineered for conditions which include fumes, splashing or continuous contact with these agents. Comprising these systems are tough vinyl,



or other coatings, and special wash primers, primers and intercoats where required

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Extraordinary service from ordinary drums

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ant Unichrome Drum Linings.

Take the new wetting agents, for instance. They tend to cause rusting in ordinary drums. Used with textiles, rust-contaminated wetting agents can cause staining. So one particular company packaged with glass—until it found that Unichrome Drum Lining Series B-124 permitted use of steal drums without risks of nutting. Not only drums without risk of rusting. Not only did this method cost less than glass, but also eliminated breakage.

Unichrome Drum Linings are available for a wide variety of products to prevent corrosion of container, and contamination. Write for data.



Chemical-resistant coatings in the heavy-duty class

Unichrome Plastisol and Organosol Compounds "4000 Series" possess a set of properties seldom found in one material. (1) They have the greater resistance of the vinyls to chemicals, oils. aistance of the vinyls to chemicals, oils, water. (2) This resistance is further increased by the thick coatings—up to %s"—that they produce. (3) And because they have fazibility, they withstand mechanical damage as well. (4) They are applied by dipping or spraying. Here may be your answer for protecting lighter or less costly metals from strong chemical corrosion. Consult "Coatings for Metals" headquarters for more information.



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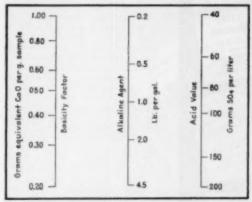
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Quotes, Extracts and Digests

MORGAN M. HOOVER, Assistant Edit



Staking Medium, Gal. Filtrate used for 12,000 lime sloking Additional required when water is used 10,000 6,D00 5,000 4,000 160 140 Acid Value , Grams 804 per Liter

needed for the neutralization of one gallon of acid waste.

Fig. 1-Nomograph for finding the pounds of alkaline agent Fig. 2-Savings in total volume of liquid when filtrate is used as the slaking medium. Based on 20,000 gal. of acid waste.

\$25,000 Lime Neutralization Plant

Wallace E. Wing

NOTE: This paper concerns itself with steel mill waste liquor. However, most of this liquor is, at the present time, very similar to titanium pigment plant waste liquor and any method of handling would be generally similar.

Slow filtering rates and difficult sludge disposal problems have plagued lime neutralization investigations. These difficulties have apparently been largely overcome in the work described here.-EDITOR.

THE PLANT was at first considered to be of small capacity, nothing more than a pilot plant. However, we discovered the plant has sufficient capacity to treat successfully about 15,000 gal. of waste pickle liquor per day, or is adequate for the treatment of pickle liquor wastes from all except the very large steel fabricating plants. This pilot plant could be reproduced at a cost estimated at \$25,000.

Our results point to an effective, cconomical method for precipitating and removing most of the dissolved salts in the acid waste. The filtrate remaining is water clear, slightly alkaline, and acceptable for discharge into most rivers and streams. The precipitate or sludge is removed on a continuous filter in the form of a relatively dry filter cake which is dry enough to be handled without trouble on most any type of conveyance.

The plant consists of five cypress tanks, a Duriron pump, a circulating pump, a 1 ft. x 3 ft. rotary vacuum string filter with the necessary auxiliary equipment. There are two 6 ft. x 6 ft. 1,275 gal. cypress tanks, one of which is used for the storage of acid waste pickle liquor and the other as a reactor tank (equipped with agitator). There are also three 4 ft. x 4 ft. tanks of 275 gal. each, two of which are used for effluent storage and the other for slaking lime or for dry lime feeding. This latter one is also equipped with an agitator. A small Duriron pump is used to pump the acid waste into the storage tank from a tank truck especially equipped for the purpose. A Wilfley pump is employed for circulation during neutralization and for handling the slurry to the filter. After precipitation on a FEINC 1 ft. x 3 ft. rotary vacuum string filter which has a filter area of 9.4 sq. ft., the slurry is filtered.

Some laboratory work is necessary before starting a neutralization run. First, the acid value of the waste to be treated must be determined. Then, the basicity factor of the alkaline agent must also be calculated. In these calculations the procedure re-ported by Hoak, Lewis, and Hodge of Mellon Institute in their paper, "Basicity Factors of Limestone and Lime" was followed. Their nomograph, shown in a simplified version (Fig. 1), makes it possible to determine the amount of alkaline agent (lime in this case) required to neutralize a given amount of acid. The acid value is determined by titrating a 5 ml. sample of pickle liquor with an excess amount of 0.5N NaOH precipitating the iron and removing it by filtration. The filtrate is then titrated with 0.5N HCl to a phenolphthalein end

With these data it is simple to calculate the acid value in terms of grams sulphate ion per liter, which gives the acid value in the nomograph. The basicity factor of the lime is determined by titrating one gram sample of alkaline agent with an excess of 0.5N HCl, boiling the sample for 15 min. and back titrating with 0.5N NaOH to a phenolphthalein end point. The basicity factor is expressed as grams equivalent CaO per gram of lime. This provides two points on the nomograph from which a line can be drawn, and the intersection at



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QED, cont . . .

the middle scale indicates how much alkaline agent is required in pounds per gallon to neutralize the acid waste. This is the starting point for lime neutralization.

DRY LIME TREATMENT

Plans were made to use all of the readily available forms of lime which consisted of high calcium pulverized quicklime, high calcium hydrate, pulverized dolomitic quicklime, and dolomitic hydrate. From the standpoint of economy, the hydrates usually eliminate themselves. The quicklime has the advantage of generating some heat. which reduces the reaction time and increases the filtering rate. Studies with high calcium quicklime in the pulverized form were begun by adding the dry powder directly to the acid waste which was agitated in the reactor tank. Our own experience in handling lime indicated that considerable difficulty would be encountered in feeding uniformly a small amount of finely pulverized quicklime. To overcome this difficulty, we developed a simple device consisting of a Syntron Feeder which vibrated the screen. By feeding the lime manually into a hopper over this screen it was possible to add the lime at approximately the correct rate and in the proper form. Obtaining satisfactory dispersion of the lime was important. In-cluding the time needed for feeding the lime, it required a total of 2 to 3 hr. to neutralize 200 gal. of acid waste. This provided complete neutraliza-tion using slightly under 10 percent excess lime over that stoichiometrically required. We filtered these solids on the rotary vacuum filter with a fairly dry cake which could be readily handled.

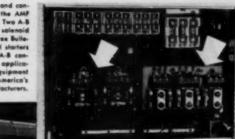
LIME SLURRY

Our interest in employing dry lime neutralization was predicated on the belief that the final sludge volume would be reduced and would be more readily filterable by maintaining the water solution at a minimum. However, it was decided to make a comparison between the application of lime in a dry state and in a slurry form.

In using lime in a slurry form, the slaking procedure required proper manipulation. Two pounds of lime slaked in 1 gal. of water gave us about the right consistency for treatment of the pickle liquor. The addition of water increased the final sludge volume considerably, which was an undesirable result since it complicated the disposal of the waste. However,

(Continued)

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A-B Bulletin 609 in Nema 4 watertight enclosure.

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A-8 Bulletin 800 In Nema 4 watertight enclosure.

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KIRK-BLUM

The Kirk & Blum Mfg. Company 2907 Spring Grove Ave. Cincinnati 25, Ohio QED, cont . . .

using the proper amount of lime with the correct excess over the theoretical, it was possible to produce a slurry of good filterability, which yielded a filter cake that was dry enough to handle easily.

The natural sequence of this operation called for reversing the opera-tion, that is, adding the acid waste to the lime slurry. This produced very satisfactory results with a satisfactory neutralization reaction, an excellent filtering rate, and a fairly dry cake. The agitation of the lime slurry was augmented with a recycling of the slurry as the acid was being added so that the degree of turbulence in the reaction vessel was increased. In employing this method, complete reaction occurred by the time the final acid was added. In each case the completeness of neutralization in the reaction tank was checked by deter-mining the pH. When a pH of 9 or higher was reached the reaction was considered complete. The filter cake (sludge) which was produced contained approximately 58 percent moisture, which was dry enough to be handled with ease. The resulting filtrate was clear.

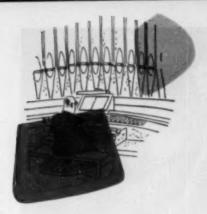
FILTRATE UTILIZATION

Next, our attention was centered on the utilization of this filtrate for slaking the lime. In general, it was possible to use a sizable percentage of the filtrate for slaking the lime without affecting the reaction time adversely.

Fig. 2 reveals the savings in total volume of liquid when the filtrate is used as the slaking medium. In the extreme lefthand column of Fig. 2 where the acid value of the liquor reaches 220 g. SO, per liter, it is interesting to note that only 8,800 gal. of filtrate are required to slake the lime. If the same amount of lime is slaked in water alone, it will require 11,800 gal. of water. Looking at the extreme right of the chart, with a low acid value of 100 g. SO, per liter it requires only approximately 3,900 gal. of filtrate to slake the required amount of lime, while 5,200 gal. of water are needed to slake the same amount of lime. This empha-sizes the savings in final waste volume when the filtrate is used as the slaking medium. The results which were obtained clearly demonstrate the advantage of slaking the lime with the filtrate from the standpoint of good filterability in addition to the reduced volume of filtrate. As an example, it was found possible to slake 3 lb. of lime per gal. of slaking medium in-(Continued)







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Although it is but one instrument, the organ can reproduce a single musical pattern in a multitude of tones and varied effects. Sivyer offers the same unusual flexibility in castings. The composition, the characteristics of a casting...even though the pattern is the same...can be varied to suit a wide range of needs or conditions.

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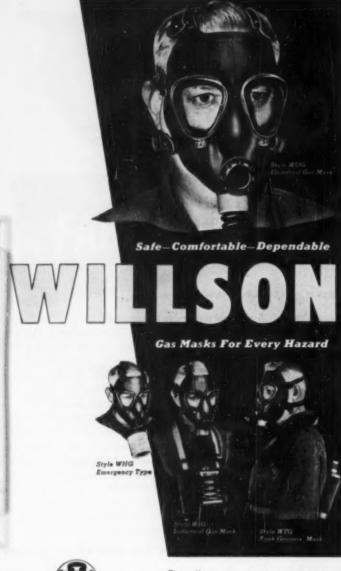


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SIVYER

IVVER STEEL GASTING COMPANY . MILWAUKEE DENICACO









For effective protection against acid gases, organic vapors, carbon monoxide, fumes, mists, smokes and similar hazards, there is a WILLSON Gas Mask approved by the U.S. Bureau of Mines. They have been designed with every consideration for worker safety and comfort. A selector table and complete information on various types is included in our new catalog. Ask our nearest distributor for a copy or write direct to WILLSON PRODUCTS, INC., 106 Thorn St., Reading, Pa.

ANY VOLUNTEERS?

"At every council table around which negotiations between labor and management are conducted, the consumer is the unseen, though deeply interested party, yet no one pleads on his behalf." CHARLES SAWYER Secretary of Commerce

QED, cont. . .

stead of 2 lb. per gal. when water was employed. This is credited to the deflocculation of the calcium hydroxide in the slurry. It is our opinion that the presence of calcium sulphate in the waste is largely responsible for this phenomenon. In addition, by using this lime slurry made from the filtrate a better, more readily filterable sludge was produced with a heavier and drier cake. It was also observed that the temperature of the acid waste greatly affected the reaction time and the filtering rate. The hotter the acid, the more rapid the reaction; and the higher the filtering rate, the lower the moisture in the filter cake.

Wallace E. Wing, Marblehead Lime Co., before the Fifth Industrial Waste Confer-ence, Purdus University, Nov. 25 and 30, 1343.

EROSION

. . . Synthetic Rubber

E. M. Fettes and J. S. Jorczak

Pump casings and pipe fittings can be protected from the erosion of turbulent water by a new process in which powdered synthetic rubber is sprayed through a ring of flame.

The flame spraying technique, developed for the Navy during the war, covers the metal with a molten rubber which fuses to a resistant coating.

Prior to development of these coatings, expensive equipment had to be completely replaced when cavitation progressed beyond a certain point.

The coating absorbs the shock and the rubbery properties distribute the force. The coating itself is not subject to crosion.

With the improvements in the spray powder and in the methods of application perfected during this last year, the technique appears suitable for industrial applications.

The basic composition used for coating is a tough rubber-like powder which is chemically stable when exposed to a wide range of solvents and is specially effective in salt water exposure. The product is applied by using a controlled flame melting the powder just prior to depositing it on (Continued)

SOLVING A DRYING PROBLEM



Here you have the letter "H", before and after being broken up into fragmonts. Put the pieces together again, without ceiting them out, to farm the letter. LOOK FOR THE SOLUTION WHICH WILL APPEAR NEXT MONTH. (FAR: 4 min.)

IS SOMETIMES LIKE PUTTING THE PIECES OF THIS PUZZLE TOGETHER

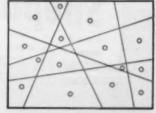
Solving your drying problem is something like doing a puzzle on a major scale and for high stakes. In both cases you must have a clear conception of the problem and the end result to be achieved. Then you must study the component parts and analyze the avenues of approach open to achieve the desired result.

It sounds simple enough and yet—the one thing to keep in mind is that in tackling the solution to a drying problem, time and effort represent money. If you can find any way to shorten the time and effort that you must put into the solution—you are financially that much better off.

One of the surest ways to shorten the time and effort that go into the solution of a drying problem is to know that drying is to be a part of your process. This early consideration is vital, for the type of drying equipment you are considering may well have an important bearing on preliminary or subsequent processing. In continuous processing, drying is one link and must be considered as part of the whole line. Proctor engineers' long experience enables them to help you cut through to the heart of your problem with a minimum of time and effort.

The facilities of Proctor research laboratories are available to you without cost or obligation. Those who have availed themselves of these facilities have found that it has always worked to their advantage. If you are considering a process where drying is a link—take Proctor engineers into the picture with you today. Call or write.

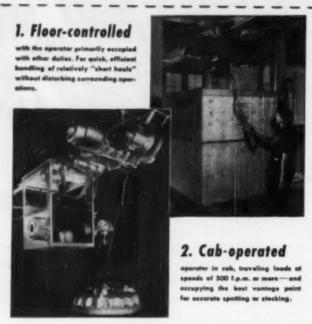
The problem was—draw six lines across the rectangle in such a way as to separate each small circle from every other circle.



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We have given our complete attention to the manufacture of both types of hoists-and a complete line of overhead cranes for a good many years. So we approach "through the air" handling with an open mind and a great deal of experience. May we show you pertinent data on installations similar to yours?



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LA PRIMADORA, CORONA CORONA??

"I have asked many business executives how they make up their minds whether to require a two-year or four-year payoff on new equipment, or their equivalent, a 50 percent or a 25 percent return, and I have yet to get an adequate rationalization of their positions. They appear to have their favorite payoff requirements or rates of return just as they have their favorite cigars."

GEORGE TERRORCH, Research Director Machinery and Allied Products Institute

OED, cont. . .

the steel surface. The coating is ac-tually fused to the steel surface and it is bonded so family that it is extremely difficult to remove the coating once it has cooled to normal temperatures.

The application equipment resembles a welding torch but has controls for flow rates of gases and the powder. The powder is delivered as a stream passing through a ring of flame. The powder becomes liquid at contact with the flame and fuses to an impermeable film on the steel. The steel surface is prepared for the coating by sandblasting, and the surface to be coated is preheated with the flame prior to release of the powder. The film is built up with successive passes until the coating is about in. thick. The fused film has properties between those of a hard plastic and those of a tough rubber.

E. M. Fettes and J. S. Jorczak, Thiokol Corp., before Division of Industrial and Engineering Chemintry, American Chemi-cal Society, Houston, Tex., March 39, 1826.

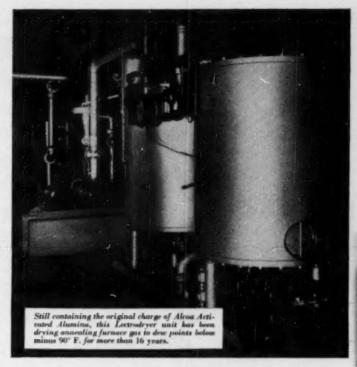
EQUIPMENT CLEANING . . . Better Method

T. E. Purcell and S. F. Whirl

Inhibited phosphoric acid removes rust and mill scale from new boilers, and water-formed insoluble deposits from serviced units, without the limitations and adverse effects associated with inhibited hydrochloric acid.

The principle advantage of phosphoric over hydrochloric acid is that it can be boiled in the unit by direct firing of the boiler with negligible attack of the metal. This is possible because the inhibitor is effective at these temperatures. In addition to the beneficial washing action, the resulting natural circulation promotes distribution and provides a sufficiency of acid at the desirable locations at all times. Furthermore, the boiling operation sends solutions into certain regions at the top of the boiler which (Continued)

Carnegie-Illinois
Steel Corporation
maintains
extreme dryness
in furnace
atmospheres



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In the manufacture of USS silicon steel products at Vandergrift, Pa., Carnegie-Illinois Steel Corporation uses great care in the control of annealing-furnace atmosphere. The absence of moisture in the gas is as important as its composition. Therefore reliable drying equipment and a reliable drying agent are essential.

With ALCOA Activated Alumina, Carnegie-Illinois Steel Corporation dries furnace gas to dew points below minus 90° F.

The drying unit illustrated was installed over 16 years ago, and still contains the original charge of ALCOA Activated Alumina!

Day in and day out, this unit has been drying 15,000 cu. it. of gas per hour, on a 12-hour cycle. Each of the two towers contains 1,500 lbs. of ALCOA Activated

Alumina. Gas enters the towers at 50° F. to 90° F. Regeneration temperature is approximately 350° F.

During the 16-year period, the one charge of ALCOA Activated Alumina has dried more than 1,971,000,000 cubic feet of gas. This means that each pound of alumina has dried 657,000 cubic feet.

High resistance to shock, abrasion and erosion, plus the fact that reactivation may be repeated an almost unlimited number of times are reasons why ALCOA Activated Alumina can be depended on for so many years.

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Alcoa Chemicals



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THE POLITICAL OCTOPUS

"Once the dead hand of politics gets its convalisive grip on American business and industry, free competition will be strangled, and our economic system will be no different—and no more successful—than those noble experiments which are crumbling into dust in Europe."

BRESIAMIN F. FARKERS, President

BENJAMIN F. FARLESS, President United States Steel Corp.

QED, cont. . .

otherwise could not be reached except by recirculation with an elaborate sys-

tem of internal baffling.

By contrast, inhibited hydrochloric acid can be used only at temperatures below 150-165 deg. F. Above this temperature, the effectiveness of the inhibitor decreases with progressively more severe attack of the boiler metal. With hydrochloric acid, the acid cleaning process must therefore consist either of soaking, or recirculation with external heating.

External heating by steam jets or heat exchangers increases the complexity and the cost of cleaning operation, while attempts to utilize the sensible heat of the furnace and boiler without recirculation would introduce hazards of imperfect mixing, acid excess or deficiency, corrosion due to hot spots and the possibility of in-

adequate cleaning.

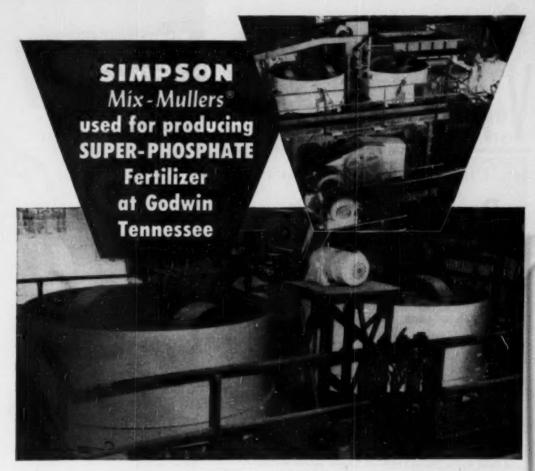
Other advantages are the greater stability of phosphoric acid which eliminates the corrosive and fume problems of hydrochloric acid, and the rust resistant surface left by the

use of phosphoric acid.

Even at room temperature, hydrochloric acid vapors leave the solution. As the temperature is increased to that encountered in boiler cleaning, the rate of decomposition becomes appreciable. Since the inhibitor remains in the solution, its benefits do not extend to the vapor; thus the metal surfaces of drum, safety valves, boiler and superheater tubes above the level of the cleaning solution are exposed to corrosive uninhibited hydrochloric acid.

While the valves may be protected by their removal and superheaters by filling with condensate or isolation, there are always some regions that are beyond protection. During the cleaning operation with hydrochloric acid, invariably, HCl vapors pervade the plant atmosphere. These fumes are not only corrosive to power plant equipment, meters and exposed metal work, but also are toxic to plant personnel.

It was found that a five percent inhibited phosphoric acid solution boil-(Continued)



ILLUSTRATED here are two views of the Simpson Mix-Mullers installed in the briquetting unit at the Godwin, Tennessee, fertilizer plant operated by the TVA.

These two Mix-Mullers are used for accurate, controlled mixing of Super-Phosphate fertilizer. They are arranged for automatic operation through the use of overhead conveyors, solenoid valves for liquid additions, and positive, centralized control through a National "Timemaster" automatic control unit.

This is just one example of the way in which Simpson Mix-Mullers are being used to solve all types of mixing problems throughout the chemical process industries. For further details, send for your copy of our latest 8-page catalog.

Use Our Free Laboratory Service

equipped modern testing laboratory for determining the results of mixing different products in Simpson Mix-Mullers. A confidential test in our laboratory will prove what a Simpson can de for you. Write for details.



SIMPSON Mix-Muller Division

NATIONAL ENGINEERING CO., 604 Machinery Hall Bldg., Chicago 6, III.

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is not the spice of life here but it

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Midwest offers a large variety of welding fittings to help you improve your piping. Many of these fittings were originated by Midwest for the purpose.

For example, the Midwest Reducing Elbow saves a third of the welding, decreases turbulence and pressure drop and improves appearance when used instead of a standard elbow and reducer. Midwest Long Tangent Elbows have a tangent or straight section at each end equal to 1/4 the nominal pipe size; this saves pipe, saves time in lining up, and often saves welding. (These are in addition to ASA Type and Short Radius Elbows.) Midwest Sleeves relieve the line butt weld of all bending stress and much of the tensile stress. Midwest Saddles restore the original pipe strength and reinforce the joint.

Use of Midwest Welding Fittings assures maximum improvement and economy in piping. For your welding fitting needs, get in touch with the Midwest Distributor near you.



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ing at atmospheric pressure gave good deposit removal, negligible attack of metal and a surface resistant to rusting.

T. E. Purcell and S. F. Whirl, Duquesse Light Co, before the American Society of Mechanical Engineers, St. Louis, June 22, 1950.

SHALE OIL

. . . Becoming Competitive

E. D. Gardner, E. M. Sipprelle, Boyd Guthrie and L. W. Schramm

Recent developments in mechanized mining at the U. S. Bureau of Mines oil-shale mine near Rifle, Colorado, have lowered mining costs to 29c. per ton of shale. This is considerably less than previous estimates and means correspondingly lower production costs of synthetic liquid fuels made from shale oil.

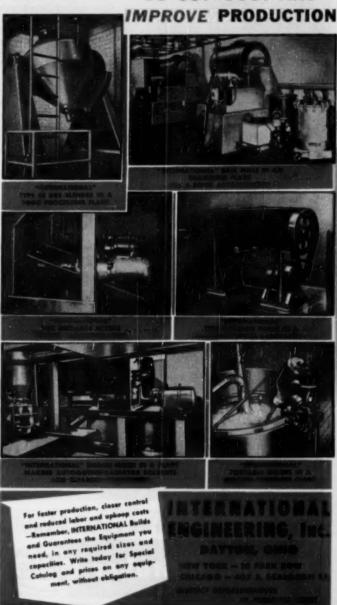
The cost of producing crude shale oil from 30 gal. per ton shale, using the new mining and processing techniques, would be about \$1.50 per bbl. This includes estimated out-of-pocket operating costs and depreciation but not income taxes or profit. A year ago a Bureau of Mines estimate, excluding interest on investment and profit, was approximately \$2 per bbl.

At that time it was estimated that the cost of gasoline, diesel oil and heating oil made from the crude shale oil would be about 8.4c. per gal. The sharp rise of petroleum crude in the last few years due to the increased difficulty of finding new petroleum, together with the technological advances in mining and processing oil shale and refining shale oil is bringing the cost of liquid fuels from petroleum and liquid fuels from oil shale close to the same level.

If present trends continue, it will not be long until shale oil can supplement petroleum at a comparable price. The Green River Formation includes the richest known deposit of oil shale in the country. It is estimated that 300 billion barrels can be produced from a 500-ft. thick measure of this formation over a 1,000 sq. mi. area of northwestern Colorado.

From a high-grade section 60 to 100 ft. thick occurring near the base of the 500-ft. measure, it is estimated that 100 billion bbl. of shale oil could be produced from the same area. This section is called the Mahogany Ledge and is the one in which the bureau's oil-shale mine is located.

The equipment developed for exploiting the Mahogany Ledge includes unique four-drill jumbos for drilling (Continued) International, to work in your Plant TO CUT COST AND



The STANDARDAIRE PRECISION BUILT Axial Flow BLOWER ~



Here's another important design feature of the Standardaire Blower — HEAT TREATED ALLOY STEEL TIMING GEARS—generated and shaved to extreme accuracy for quiet operation.

THESE helical gears keep the cycloidal form, screw type rotors of the Standardaire Blower in timed relation. There is no wind-up

in the shafts between the rotors and gears as a very small percentage of the in-put power goes through the timing gears. The male or main rotor does the work and consumes the power; the female rotor acts simply as a valve or gate—further evidence of the finer features found only in the Standardaire Blower. The Standard Stoker Co., Inc. Dept.—C-18 370 Lexington Ave., New York 17, New York.



Typical inotaliation of a Standardaire Blower as installed in a malting plant.

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QED, cont . . .

heading and bench rounds, a portable 1,500 cfm. utility compressor station, a mobile platform from which to charge blast holes, and a mobile telescopic platform from which it is possible to inspect any position on the pillar walls or roofstone from 5 to 70 ft. high. A standard three-yard electric shovel with a shortened boom and 15-ton diesel trucks are used for loading and transporting the broken shale from the mine.

E. D. Gardner, E. M. Sipprelle, Boyd Guthrie, and L. W. Schramm, Bureau of Mines, before the American Society of Mechanical Engineers, St. Louis, June 22, 1956.

CONSTRUCTION

. . . . Future Wars

A. Allan Bates

Civilization's best chance of surviving an atomic war is to make maximum use of concrete in building its towns and cities.

Reinforced concrete structures, properly designed, possess a unique combination of impenetrability to deadly atomic radiation, resistance to blast destruction, safety against fire, and last but not least, economic feasibility.

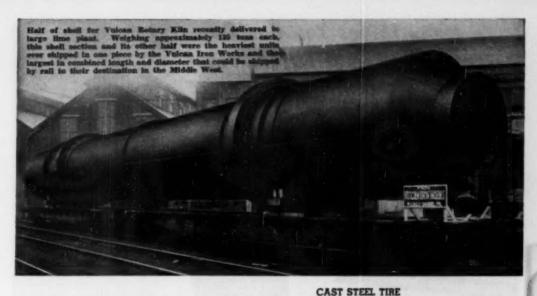
Physically, we know that practicable concrete shelters can be designed to resist the effects of all but a very close hit by an atomic bomb. Engineering estimates plus studies of results of atomic attack in Japan show that fairly adequate protection for a majority of our city dwellers during an atomic attack can be provided behind concrete walls for an expenditure only moderately greater than the cost of heave-duty factory construction.

It is true that a more or less complete dispersal of all of our cities, together with adoption of a policy of putting our principal factories and offices and most of our apartments underground would give us the greatest immunity against atomic attack. But this would be incredibly expensive and politically impossible. Nothing less than an all-out atomic war with its certain destruction of our civilization would convince our people that they should have adopted such measures.

Meanwhile, the extensive and well planned use of reinforced concrete in construction of our new buildings and strengthening parts of our old ones in or near cities will minimize the necessity of burrowing underground or of dispersing our centers of population.

No precautions that can be taken will make atomic warfare other than what it is—an indescribable nightmare of horror, death and destruction. We

(Continued)



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The longer a Vulcan Rotary Kiln is operated the greater the savings securedbecause of its very low costs for maintenance and repairs. Fifty years of continuous experience in the design, manufacture and servicing of this type of equipment has taught our engineers where operating troubles are most apt to occur and how to prevent them.

A typical example of Vulcan Trouble-Preventing Kiln Construction is the patented rivetless tire mounting shown above. Not only does it completely eliminate the rivet-popping once considered inevitable but its distinctive combination of interlocking lugs and blocks absolutely prevents creeping of the tire in any direction.

Another important advantage is the use of ONE THICK PLATE beneath the tire, instead of several relatively thin plates. thereby improving heat-conductivity and overcoming the former tendency toward burning or bulging of the shell and reinforcing bands at these particular points.

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QED, cont. . .

cannot construct practicable buildings to resist direct or very near hits by "ordinary" atom bombs. Therefore any city built above ground can be wiped out by a sufficient number of atomic bombs. The suggestions which I have made will only increase the probability that any individual or group will live through an atomic attack. The sufficient and wise use of reinforced concrete construction will materially increase the numbers of such survivors.

A. Alian Baton, Portland Coment Association, speaking at the dedication of the Association's new research and development laboratories, Chicago, June 8, 1980.

RUBBER

. . . Synthetic Carcasses

Carl S. Marvel

The American tire industry's dependence on natural rubber imports from the Far East may be ended by a modified synthetic rubber for tire carcasses which has been developed at the University of Illinois.

The new kind of synthetic rubber, or copolymer, shows great promise as a material for tire carcasses—an application in which natural rubber is still used because all previously known types of synthetic rubber build up too much heat in service. Synthetic rubber has proved satisfactory for both tire treads and inner tubes.

This copolymer is extremely interesting because it shows the lowest heat build-up of any of the synthetic rubbers and is approximately equal to natural rubber in this respect. It seems probable it may prove to be a useful carcass stock rubber, and the preliminary facts bear out that notion.

A replacement of natural rubber for use in the carcasses of tires is needed to make the United States independent of the Far East for its rubber needs.

Still further tests are needed before it is definitely established that this polymer will make good tire carcasses. The copolymer is made of butadiene and styrene by a process employing sodium as a catalyst.

Carl S. Marvel, University of Illinois, b-fore the Chicago Section, American Chemical Society, Chicago, May 20, 1950.

OIL

. . . and Water Treatment

Joseph N. Breston

Billions of barrels of oil will be added to the nation's reserves through the application of improved techniques for secondary recovery by water flooding.

(Continued)



The all-important nerve center of a processing operation requires good design and skillful installation—a job for a seasoned organization.

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Aerofin finned surface jacket-water cooling installation, La Gloria Corporation, Falfurrias, Texas. Designed to cool 334,200 gallons of water per hour from 155° to 145° using 100° ambient air. Heat transfer 27,850,000 BTU/hr. Engineered and built by Hudson Engineering Company.

Whatever the heat-transfer problem — whatever the medium—whatever materials are required for highest efficiency and lowest maintenance costs, you can always rely on Aerofin.

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Acrofin is sold only by manufacturers of nationally advertised fan system apparatus. List on request.

QED, cont. . .

The treatment, requiring only 1 to 6 lb. of a single chemical for every million pounds of water, has averted the abandonment of many oil wells which were close to the limit of economic production.

Two classes of chemicals are used. They are high-molecular-weight alkyl and aryl amine-type compounds, and certain ethylene oxide-amine condensation products.

Except for filtration, no other treatment is necessary. The chemicals used are capable of being adsorbed onto the pipe surface in very thin protective layers. Thus, in addition to being very effective bactericides they are also practical corrosion inhibitors.

Such water treatment has been tested on many oil leases by the Quaker State Oil Refining Corp. and other producers in the Bradford field and has proved very successful. Besides cutting down on the cost of water treatment and general maintenance of the water distribution system, there is a definite indication of increased oil production.

The secondary recovery of petroleum by water flooding involves the injection of water under very high pressures into specially drilled wells. The water is forced into the porous oil sandstone where it pushes the oil ahead of it and into the oil wells which are drilled about 200 ft. away.

Since the pores or openings in the sandstone containing the oil are as little as one ten-thousandth of an inch in diameter, it is very important that the water be extremely clean. The most minute particles of dirt or even bacteria can easily plug these oil sandstone pores and prevent the entry of water. Thus, it is important that the water used for flooding be treated so it will be non-corrosive, free of bacteria and very clear.

Joseph N. Breaton, Pennsylvania Grade Crude Oil Association, before the Division of Petroleum Chemistry, American Chemical Society, Houston, March 27, 1950.

PETROCHEMICALS

. . . Look Ahead

Gustav Egloff

The petrochemical industry, which was initiated only 25 years ago, now produces about 12 billion lb. of chemicals annually. Indications are that it may reach 48 billion lb. by the year 2000 and at the same time will be utilizing only 1 percent of the projected petroleum and natural gas production. These predictions are based on present demands for petrochemicals and the development of new products. Continued expansion is assured by the (Continued)

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HORIZONTAL CENTRIFUGAL AND VER-TICAL TURBINE TYPES - Peerless Underwriters' Approved Fire Pumps can be applied to practically every commercial and industrial risk requiring fire prosection. They afford dependable, low cost protection, peak quality performance and unquestioned reliability that often will result in measurable savings in insurance

SINGLE AND MULTI-STAGE — Peerless Underwriters' Approved Fire Pumps are available in two types. The Type AF, shown above, is a single stage, double suction, horizontal centrifugal design, with a capacity range of from 500 to 2000 g.p.m., affording pressures, at rated capacities, from 40 to 150 lbs, and is available in 47, 57, 67 and 8" discharge sizes.

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ALL TYPES OF APPROVED DRIVES --Peerless approved fire pumps may be equipped with any type of drive: electric, steam turbine, gasoline or diesel engine. Auxiliary stand-by engine drives may be used in conjunction with turbine or motor drive to assure instant service even in the event of power failure.

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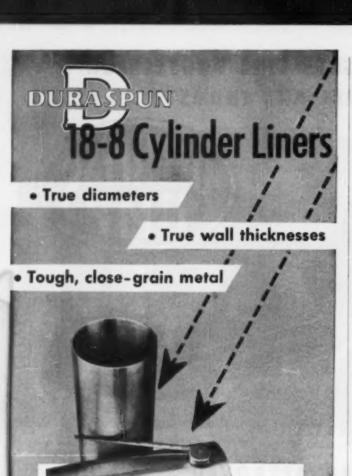






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FOOD MACHINERY AND CHEMICAL CORPORATION Fectories: Les Angaies, Californie, and Indianapolis, Indiana



Are you thoroughly familiar with the superior qualities of "centrifugally cast" high alloys...such as these cylinder liners, for example?

Centrifugally cast metal is exceptionally uniform, close-grained and strong. It is free of pits and packets. It is capable of passing very rigid tests. And the practical advantage is that as long as there is a central circular hale, almost any outside shape can be cast. Some of our customers want their castings centrifugal even though considerable boring and other machining is necessary to finish the piece.

We recommend our centrifugal casting service If your requirements call for the characteristics outlined above. Our high alloy foundry is modern in every respect and staffed by metallurgists and foundrymen of many years' experience with both centrifugal

THE DURALUY COMPANY

QED, cont. . .

reliance of petroleum companies on research. Over \$110 million is spent annually on petroleum research.

Most of the alcohols and many other high tonnage chemicals are now produced from petroleum and natural gas. Many new products have been developed such as synthetic glycerin which is important not only in meeting present demands but also as a potential source of synthetic fats to augment food supplies.

Scientifically practiced agriculture offers unlimited market for fertilizers, insecticides, soil fumigants and weedkillers. The products already developed have increased crop yields and even restored depleted farm lands to production.

The plastics industry has grown 600 percent in the past 10 years and could easily increase 25-fold in the next 50. Demand is in excess of supply for many products and new ones are continually being developed.

The synthetic rubber industry which is largely based on petroleum will increase despite availability of natural rubber. Synthetics are being improved and entirely new products better suited to many uses than the natural rubber will be developed.

Nylon is increasingly dependent on petroleum and natural gas for raw materials. New textiles such as orlon from acrylonitrile necessitate increasing petrochemical production.

The petroleum industry is a major supplier of raw materials to the detergent industry which has reached 1 billion pounds annual production and is expanding.

One of the largest future markets for petrochemicals is aromatics such as benzene. The maximum quantities available from coke-oven operation are now being produced but demands are not being met. All increases in supply will necessarily come from the petroleum industry.

The present investments in petrochemical plants exceed \$1 billion and a \$500 million expansion is taking place. This enormous expenditure attests the faith of oil and chemical industries in the future of petrochemi-

Gustav Egioff, Universal Oil Products Co., before The American Institute of Chemists, New York, May 13, 1950.

NEW PROCESS

. . . Hydrogen Peroxide

G. L. Putnam and J. F. Sullivan

A new process for hydrogen peroxide makes use of large amounts of waste hydrogen, produced as a byproduct (Continued)



Hygroscopic materials handled here, unprotected, would pick up moisture from the air, causing production to slow to a standstill. But a Lectrodryer guards against that hazard. It feeds DRY air to the department, making it independent of the outside weather.

Standing by on dry days, this Lectrodryer is ready to go to work on a moment's notice. Are you troubled with moisture in the air surrounding or entering into your processes, in gases or organic liquids? There's a Lectrodryer to remove every trace of that moisture—efficient, dependable and costing little to operate. Our engineers will help incorporate it into your processes.

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Capacities offer wide selectivity, ranging up to 200 g.p.m. Heads up to 165 ft. Motors 1/4 H.P. to 71/2 H.P. Speeds 1750 3500 r.p.m. Maximum total pressure 125 lbs. Maximum

suction pressure 50 lbs. Maximum recommended liquid temperature 200°F.

Construction features, performance charts, metal specifications for standard fitted, all bronze, and all iron units included in new BULLETIN No. 4350. Send for your copy and check the features of these new Deming MOTOR-MOUNT pumps.

THE DEMING COMPANY 525 BROADWAY, SALEM, OHIO



QED, cont. . .

of the electrochemical industry, and oxygen from the air.

The method involves the mixing of about twenty parts of hydrogen gas with one part of oxygen, heating and passing through the mixture an alternating electric current at 5,000 to 15,000 v.

The inherent characteristics of this process indicate its promise as a feasible method for hydrogen peroxide production.

About 15 kwh. of electrical energy are required per pound of hydrogen peroxide, but recently developed phosphate type glass equipment will probably lower the energy requirement greatly.

G. L. Putnam and J. F. Sullivan, University of Washington, before the Pacific Northwest Regional Meeting, American Chemical Society, Eichland, Wash., June 9, 1950.

LUBRICANTS

. . . From Olefins

F. M. Seger, H. G. Doherty, and A. N. Sachanen

A new high-quality synthetic lubricant, made from abundant raw materials such as coal, oil shale, and refinery byproducts, boasts quality standards not obtainable from petrolum oils without elaborate procedures.

Most of the crude oils now available contain lubricant fractions of lower quality than those previously used. Coupled with this trend is the demand for even better lubricant performance under severe operating conditions.

In the synthetic process, an intermediate chemical called 1-decene is produced from coal or one of the other raw materials, and 1-decene in turn is converted into an excellent synthetic lubricant by a simple heat treatment in conventional refinery conjument.

Silicones and certain fluorine compounds have been used for special lubricant applications, but there is no prospect of their extensive use in the general markets for motor and indus-

(Continued)

SAFE INVESTMENTS

"Steam-electric power plant installations being made in this country and abroad will have served their economic life before there will be such widespread use of atomic fuel as to make them obsolete before their economic life is out."

WALKER L. CISLER, Executive Vice President Detroit Edison Co.

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Two families of controllers for pH applications.



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With brand-new developments in pH equipment, plus 26 years experience in pH instrumentation, L&N now has new enswers to several important types of industrial has new enswers to several important types of industrial har problems. Furthermore, a unique, time-saving PC ontrollability Analysis" service quickly and accurately points to the control system which will solve the specific problem.

New developments in equipment cover both the electrodes which sense changes in the pH, and the housings or assemblies which hold the electrodes.

Entirely waterproof construction is featured in the new electrodes. It makes them ideal for humid or wet locations, since they are fully immune to electrical leakage as well as to penetration by process liquids.

One of the new assemblies is an immersion-type unit, to operate in tanks, reactors, etc.; it can even be totally submerged if necessary. It also operates in many places which formerly required a flow-type unit; in such cases it eliminates both the installation and the maintenance of sampling line, pump and accessories. It is made of light, corrosion-resistant plastic.

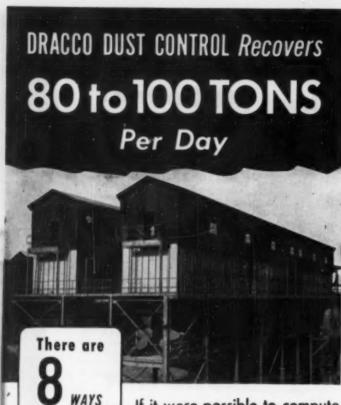
The other new electrode assembly features convenience and stability where a flow-type unit must be used. Made of plastic, it is light, small, easy to install and thoroughly dependable. Where plastic might not suit, we of course continue to supply assemblies of cast iron and/or Pyrex brand glass.

Two families of recording and controlling instruments are now available; the familiar, accurate and reliable Micromax and the newer but equally dependable Speedomax continuous-balance instrument. Both are available with either electrical or air actuated control systems.

For application engineering simply fill in one of our "Controllability Analysis" forms. Our engineers can then tell how closely pH can be held with either present or proposed plant layout. Let's get together on that pH problem! You will not be obligated; simply write to Leeds & Northrup Co., 4916 Stenton Avenue, Philadelphia 44, Pennsylvania.

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If it were possible to compute the value of recoveries made by DRACCO Dust Control, it would run into MANY MILLIONS each year. In the installation shown above, 56 compartments, DH Type, handle

280,000 C.F. of air per minute and recover from 80 to 100 tons of dust per day. DRACCO Dust Control saves money by increasing plant efficiency in 8 ways. If you have Dust, find out from DRACCO Engineers how many of the 8 ways will save YOU money. Consult DRACCO Engineers for an analysis of your dust or fume problem.

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DUST CONTROL EQUIPMENT PNEUMATIC CONVEYORS . METAL FABRICATION OED, cont . . .

trial oils, which consume a total of several million tons a year. Synthetic oils produced from coconuts and soy beans in Japan during the war have proved uneconomical in peacetime, and the high quality lubricating oils produced from coal in Germany have the disadvantage of requiring the use of an extremely reactive chemical catalyst.

A similar conversion has been accomplished in the present work by means of heat, without the use of a

catalyst.

Previous investigators have studied this non-catalytic process for the pro-duction of fuels, but they did not disclose whether the higher polymers, if

formed at all, were good lubricants.
The new product's viscosity index of 140 and pour test of minus 10 deg. F. are qualities now obtainable only in the premium-priced petroleum

The best conditions for polymerization are 650 deg. F. and 10 hours' time. The use of moderately low pressure is a distinct advantage in the design of equipment and contributes

to the practicability of the process. It is not now practical to produce decene or its equivalent. The preparation of large quantities of lubricants by synthesis remains as an alternate supply to be used at some future time of petroleum shortage.

F. M. Seger, H. G. Doherty, and A. N. Sachanen. Socoay-Vacuum Oil Co., before Division of Petroleum Chemistra, American Chemical Society, Houston, March 27, 1850.

INDUSTRY

. . . Billions, not Nickels

Roy C. Ingersoll

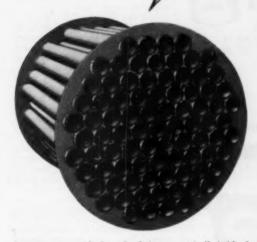
A friend of mine, an only child, was raised in a rather poor home in a rather poor neighborhood in a small town in northern Indiana. But there was one bright spot in the pictureor at least my friend thought it was a bright spot.

In a big white house on a hill at one end of town there lived an uncle. He was a kindly, indulgent, apparently well-to-do uncle. Whenever my friend needed a nickel or a dime or a quarter for soda pop or red hots or the corner movie. Uncle was a soft touch.

As a result, my friend behaved differently than the other boys in this rather poor neighborhood. While one would earn a dime by mowing a neighbor's lawn, my friend would sit on the door-step and whittle. While another

(Continued)

How You Can REDUCE TUBE REPLACEMENT COSTS by Using Carpenter Stainless Tubing



Ozone generator with glass tubes fitting concentrically inside of Stainless Tubes. Because tube replacement would involve extremely high costs, straightness, ovality and L.D. tolerances were held to close limits. Carpenter Stainless Tubing, as supplied from distributor stocks, was specified for all ozone units.

Uniform walls in every length provide a tight fit for pressure or vacuum jobs. There are no "off gauge" sections of the tube wall to give corrosion a foothold. The smooth I.D. and O.D. surfaces of Carpenter Stainless Tubing resist the formation of scale and sludge. That means longer tube life.

To reduce your tube replacement costs, send your next order to your Carpenter Stainless Tubing Distributor. One order to Carpenter will convince you that our method of manufacture can save you money on Stainless Tubing jobs.

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For useful information to help you in the selection and use of Stainless Tubing, ask for the 12-page Carpenter Data File Folder. A note on your company letterhead will start this corrosion resistance, physical property and engineering data on its way to you.

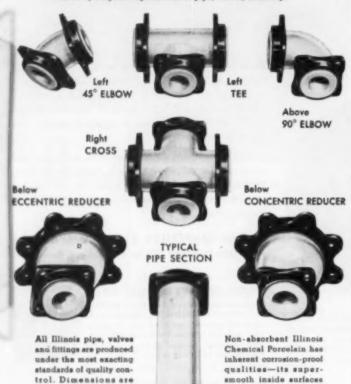


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Acid and alkali resistant porcelain keeps liquids handling systems in constant operation—reduces production losses due to corresion, electrolysis, mineral deposits and composition changes caused by frequent replacement of pipe, valves, or littings.



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FRED PREU, Assistant Managar, Special Products Department, Shell Oil Co.

OED, cont. . .

would earn pocket money by hauling ice from the ice house a few blocks away or by washing windows or white-washing fences, my friend would run up the hill to put the bee on Uncle.

He became the most shiftless boy anyone had ever seen. Even his own mother couldn't get him to do the simplest chores around the house. There was no incentive. Instead, there was always Uncle.

One day Uncle died. Being a kindly, indulgent uncle, no doubt he was welcomed in heaven. The bottom fell out of my friend's boy world. Uncle hadn't been as well-to-do as people had supposed; he died broke. No nickels and dimes any more.

So—no soda pop nor red hots, either. After awhile my friend began to look around him—for errands to be run and for chores to be done that would bring in the nickels and dimes. Incentive had replaced indulgence.

This friend of mine later worked

This friend of mine later worked his way through college, and today is a prosperous and respected lawyer in Chicago. He got on the beam once he no longer could run to Uncle.

In this we have a parable. For today the American people by the hundreds, by the thousands, by the millions are running to another Uncle named Sam. And they are running with their hands outstretched, palms upward—not for nickels and dimes, but for millions and billions of dollars.

Roy C. Ingersoll, Borg-Warner Corp., before the Rotary Club, Kalamazoo, Mich., April 34, 1950.

INDUSTRY

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E. B. McConnell

You cannot go outside the company and buy a canned program for better understanding back and forth through the ranks. The men who prepare your material must have a thorough background in the company's opera-(Continued)



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tions and a complete understanding of the problems involved. Another thing we have learned is that communication by personal contact is by far the most effective means we have for promoting understanding.

At the outset of the company's program for training supervisors in the manufacturing department, supervisors through no fault of their own were not functioning well as a passageway for two-way communication by personal contact. Many of them had not been impressed with their importance as key men in the communication system and top management had not fully appreciated their importance in this function.

A survey of employees by an independent agency disclosed three important facts: (1) 70 percent of all employees wanted more information about the company; (2) employees ranked supervisors fourth as the source of most of their information about the company, and (3) employees by a large margin would like to get their information from supervisors.

Following these investigations, management set up a program of three-day seminars, limited to 20 men each, and extended to both operating and technical staff in a series of 14 meetings.

Seminars were held in the home office, and were designed to give each supervisor an acquaintanceship with top management men from all departments. The seminars were pointed toward demonstrating to supervisors the importance of good management and human relations, and they stressed the role of supervisors as the go-between in management worker relations.

Among several benefits of the program is the discovery by supervisors that the top management group is not mysteriously tucked away in an ivory tower, but is composed of friendly hard working men with a broad knowledge of the petroleum industry.

The program, in addition, has inspired supervisors to pass along information desired by employees during their on-the-job contacts, with the results that they have been surprised at the number of opportunities they have each day to get the information down to employees. When things come up in a natural manner they are more convincing. It is easier to see the application and purpose when information is given out in small parcels that relate directly to the work or the subject being discussed.

E. B. McConnell, Standard Oil Co. (Ohio), before the American Petroleum Institute, Cleveland, May 3, 1959.—End



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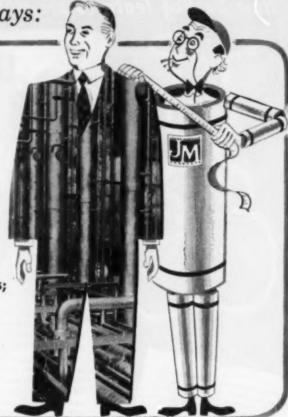


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Chemical Engineer's Bookshelf

LESTER B. POPE, Associate Editor

Lesson Two in Book Publishing

ENCYCLOPEDIA OF CHEMICAL TECHNOLOGY. Vol. 5: Di- to Explosives. Edited by Raymond E. Kirk and Donaid F. Othmer. Assistant editors: Janet D. Scott and Anthony Standen. Interscience Encyclopedia, New York. 992 pages. \$20.

Last month I told you how to revise a reference book on electrochemical engineering. This month's recipe explains how to compile a technical encyclopedia. (It is assumed that you have one basic ingredient—a publisher with faith and money.) Here, then, are the steps: (1) List the subjects to be included. (2) Get some outstanding authority to promise to write all or part of each. (3) Have his work checked by a competent reviewer. (4) Edit the manuscripts, send them to the printer, proofread.

send them to the printer, proofread.

There are pitfalls along the route outlined. Let's take a look.

Subjects—No matter how complete or comprehensive you think your list is, you will have to add to it. Some of your authors will cover their assignments incompletely. In the earlier letters of the alphabet you will have a second chance. For example, if your Lignin author doesn't come through, put in a cross reference to Pulp and Paper. Keep a record so you don't forget these cross references. Be careful. By the time you get to Zinc and Zirconium you won't have any second chances.

Authorities—Line up your writers and get them to work. The earlier the better because a few will let you down. They will promise, but not produce; they will write, but will be wrong. So you need time to corral substitutes.

Reviewers—You can't know everything, so you ask experts to check the experts. There are two desirable features to this system. First, obviously, you increase accuracy and completeness. Second, if writer-expert X plugs X company products, reviewer-expert Z will surely point out that Z company products should be included.

Editors—One of your chief rewards is going to be the satisfaction that comes from a job well done. Users of your encyclopedia will never realize

nor stop to consider your efforts. They see authors' names on the various articles. Readers will never know how much of each one is your work. With a large list of authors, it is inevitable that a few articles will be unreadable. With several authors on one subject, you will have to tie the whole subject together. Your readers—users of your encyclopedia—will never know nor thank you for making the article complete, comprehensive and readable.

Example—Above you have a hint of the work and reward attached to a particular publishing venture. Now let's see how good a job the editors did on the fifth Interscience volume

-Di- to Explosives.

The first long entry is Dialysis—an important subject in the rayon and electrolytic copper industries. Dielectrics, next long one, could be called a "use" article—it stresses applications and uses as well as theory. Diffusion (57 pages) is probably the best single article in Vol 5. It covers theory and applications of the three methods of separation: mass, thermal and gaseous diffusion. These methods, which differ from distillation and absorption in that they use an irreversible flow of heat or material, are comparatively inefficient. They are used in isotope separation.

Distillation (by Scheibel), Drying (by Marshall) and Evaporation (by Badger) are in the volume. These unit operations are adequately handled. There are long articles on Driers and Metallic Soaps, Dry Cleaning, Drying Agents, and Drying Oils. The Dust item covers two aspects: engineering and industrial hygiene. The dust removal problem is treated elsewhere in Electrostatic Precipitation, for example.

The articles on Dyes (128 pages) are important. They bring together a lot of material that's difficult to find. They cover nomenclature, history, economics, classification, application,

evaluation.

The "E's" begin with Economics, Chemical-a 19-page review by Chaplin Tyler. The editors then skip all references, cross or otherwise, to eddy currents, edinol, effervescence, efficiency, and efflorescence. Eggs come next, 13 pages by Alexis Romanoff who is an authority and author of the recent "The Avian Egg." The editors immediately return to subjects of greater interest to chemical engineers: Electric Instruments, Electroanalysis. Electrochemistry (54 pages by Akerlof) is a good solid review of theory. It supplements nicely the 36 pages (by Faust and Safranek) on Electroplating. The couple of pages on Electrodecantation are interesting. Electrosynthesis tells some of the trick things that have been and can be done in a comparatively new field. A short interesting article is Embalming Fluids. Surprisingly enough, this is the only place where the editors allowed an author to editorialize.

Other long articles expound on Emulsions, Enamels, Enzymes, Equilibrium, Esterification and the book

(Continued)

YOU DON'T SAY!

-Oddentities from Vol. V, "Encyclopedia of Chemical Technology"

In 1948, \$37½ million was spent for dry cleaning solvents, snaps and chemicals. No definition for dust has been completely satisfactory.

In the U. S. today more than 1,000 individual dyes are produced.

Wool as it comes from the sheep contains 50-80% impurities.

To spend money for research is no guarantee of success.

With age, eggs may change in odor and flavor.

More than 600 atomic species are known for less than 100 elements.

France prohibited the use of arsenic in embalming fluids in 1846.

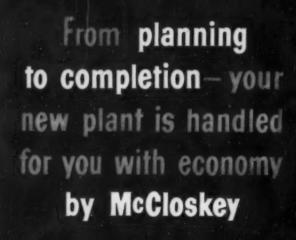
Emulsion technology is based on trial-and-error experience.

Almost all inorganic compounds are potential ingredients for enamels.

Young rats are not as prone to diuresis as older ones.

Most commercial ether is a byproduct of alcohol production from ethylene.

Under certain circumstances, manufacture of ethylene from ether is economical.



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BOOKSHELF, cont. . .

winds up with Explosions. (Continuing the pyrotechnics, Vol. 6 will start

with Explosives.)
You and I now know how to compile an encyclopedia. As experts we can appreciate the work that went into the Interscience volume under discussion. As users of this chemical reference book (and its mates) we can appreciate the editors' efforts toward completeness, comprehensiveness and readability.-LBP

Abstract Theory

PHYSICAL CHEMISTRY OF THE HY-DBOCARBONS, Vol. I. Edited by A. Farkas. Academic Press, Inc., New York. 453 pages. \$8.50. Reviewed by Gustav Egloff

"Physical Chemistry of the Hydrocarbons," Vol. I, covers nine fields, written by the following experts: G. W. Wheland, M. H. Jellinek, J. J. Mitchell, Norman D. Coggeshall, Andrew Gemant, Alfred W. Francis, M. R. Cines, and Frederick D. Rossini. Specialists of the Universal Oil Products Co., Donald Long, D. L. Holden, J. B. Grutka, A. J. De Rosset, and C. H. Watkins, have reviewed sections of the book. They comment

as follows: With the exception of the sections on applied mass and optical spectroscopy, this book has emphasized abstract theory too greatly. This is particularly true since the theory appears often to be presented for its own sake, little attempt being made to derive mathematical relations in a form convenient for use.

The chapter on the chemical bond contains a rather interesting qualitative discussion of valence theory, bond angles, bond types, strain theory and resonance. A few applications to hydrocarbon chemistry are given.

However, roughly half of the chemi-(Continued)

RECENT BOOKS RECEIVED

Advances in Colloid Science. By H. Mark & E. J. W. Verwey. Interscience. \$7.50. he Alkaloids—Chemistry and Physiology. Vol. I. By R. H. F. Manske & H. L. Holmes. Academic Press. \$10.

Analytical Absorption Spectroscopy. By M. G.

Mellon. Wiley. \$9. Introduction to the Transfer of Heat and Mass. By E. R. G. Eckert. McGraw-Hill.

Materials Engineering of Metal Products. By N. E. Woldman. Reinhold. \$10. Pocket Encyclopedia of Atomic Energy.

Frank Gaynor. Philosophical Library. \$7.50. Principles of Ionic Organic Reactions. By E. R. Alexander. Wiley. \$5.50. Properties of Metals at Elevated Tempera-tures. By G. V. Smith. McGraw-Hill. \$7.

Safety in Factories. International Labour Office. \$8.50.

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cal bond chapter is devoted to mathematical formulas of quantum mechanics which will not be understood by anyone other than a fellow expert. This lengthy discussion hardly helps one appreciate the later results; for example, why the chosen set of "hybridized bond orbitals" on page 35 is "reasonable." It is also felt that the usefulness of the mesomeric concept of the English theorists (Ingold and others) is dismissed rather lightly.

The chapter on x-ray and electron diffraction contains so much theory that it largely overbalances the practical applications. For instance, the theory of x-ray diffraction by both gases and liquids is discussed at length, but hardly any results are given. A number of applications of x-ray patterns are omitted; for example, "finger-printing" organic compounds, and determining their crystallite size, molecular weight or degree of orientation. The best section is that on x-ray diffraction by crystals. Two interesting tables summarizing important x-ray and electron diffraction results on hydrocarbons are given.

The chapter on mass spectroscopy is well presented and is much more practical than most other chapters. Certain information given is rather misleading, however. For example, with occasional sensitivity checks using a known gas, recalibrations do not have to be carried out weekly, but may even be reliable for six months. It is not necessary to remove carbon dioxide, since it can be determined directly. It is also misleading to indicate that "for hydrocarbons ranging up to Co's, the mass spectrometer is an accurate and versatile analytical tool." While the technique is useful, the above statement certainly does not apply even to the Co olefins and nabithenes.

naphthenes.

The chapter on the theory of optical spectroscopy is better than comparable

spectroscopy is better than comparable sections of other chapters since a number of examples illustrating the theory are given, and one does not lose sight of the experimental side. The chapter on optical methods of analysis is well written. However, one gets the impression that gas analysis of hydrocarbons by infrared spectroscopy is a rapid and convenient technique. In practice, a mass spectrometer is almost always used because time consuming distillation is avoided and more components can be determined. It is also well to point out that the H-l and H-2 lamps mentioned as suitable lamps for Raman spectroscopy are seldom used because of their high background intensity.

The treatment of the solvent extraction of hydrocarbons is primarily on the theoretical side also. However, many critical solution temperature data are given. These, together with references to the literature on specific ternary systems should prove useful.

Emphasis in the chapter on solidliquid equilibria is on pure compounds, and no systems of present day technological importance are discussed. The author discusses the timetemperature and precision calorimeter techniques for determining freezing points and heats of fusion. He shows a decided bias for the latter method with which he was associated in 1947 The process of purification by crystallization is presently of limited application, but the extreme degree of purity cited by the author for certain separations indicates interesting future possibilities of commercial employment.

The theory in the chapter on thermodynamic equilibria is very well presented. There is an important typographical error in Eq. (3), p. 364, which should read dE = 30 - d (PV). Unfortunately, there is little or no discussion of the significance of the various thermodynamic properties, or of how the data in the tables can be used. It has apparently been assumed that the scientists reading the book are already well acquainted (Continued)



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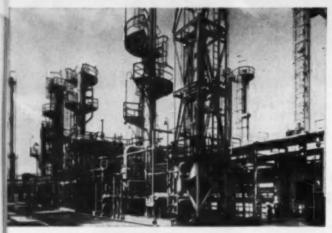
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BOOKSHELF, cont . . .

with the utility of the data. Equilibrium diagrams are given for many reactions involving O_t, H₂, H₂O, CO, and CH₄. Other useful diagrams on the equilibria of the low molecular weight paraffins and olefins are given.

This book contains a few wellbalanced chapters that would provide a good introductory orientation in the fields covered. The bibliographies at the end of each chapter are well chosen and would provide a good guide to further study.

10 + 2 = 12

TWELVE LECTURES ON THEORETI-CAL RHEOLOGY. By Marcus Reiner. Interscience Publishers, New York. 162 pages. \$4.

Reviewed by George E. Alves

"Twelve Lectures" is the second book on rheology by the author to be published recently. This book is an enlargement and revision of the author's "Ten Lectures" published in 1943.

The initial lectures are devoted to definitions, use of tensors, classical bodies, and application of Mohr-circle to represent the stress tensor.

Dimensional analysis and rheological similarity are treated in one lecture. Another deals with rheological models. These are made up of three basic mechanical elements—the spring to represent elasticity, the dashpot to represent viscosity, and the movable weight on a surface with sliding friction between both to represent yield stress.

Simple pull of a rod, simple bending of a beam, strength, rupture, and equations of Navier-Stokes and Hagen-Poiseville are discussed in other lectures.

Later lectures are devoted to topics such as creep, Bingham body, the flow of a Bingham body in a tube and the corresponding behavior in a concentric cylinder viscometer, and generalized and special bodies.

Amplifying notes are at the end of each lecture. A systematic notation is used and is well explained at the beginning of the book. Included is a large bibliography. In the index the appropriate symbol is given after all quantities. Having quoted in his recent book "Deformation and Flow" page references to the "Ten Lectures," a table is appended giving the page numbers in the present book corresponding to those in "Ten Lectures." (For a review of "Deformation and Flow" see "Chemical Engineering," lune 1950.)

In general, the book is a more

(Continued)



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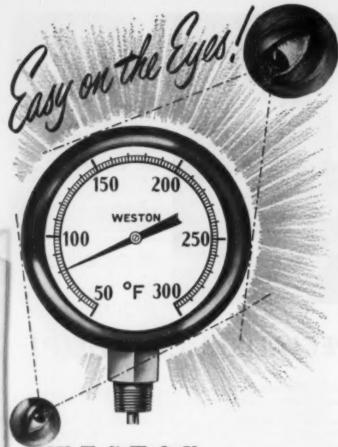
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BOOKSHELF, cont. . .

mathematical exposition of portions of the material presented in "Deformation and Flow." This book is written in a clear informal style; however, a fair knowledge of mathematics would be helpful to the reader.

"Twelve Lectures" can be recommended to chemical engineers interested in the theoretical aspects of rheology.

Hopeful Tone

COAL, COKE, AND COAL CHEMI-CALS. By Philip J. Wilson, Jr. and Joseph H. Wells. McGraw-Hill Book Co., New York. 509 pages. 53

Reviewed by Jerome J. Morgan

The authors are Former Senior Fellow and Senior Fellow respectively of the Carnegie-Illinois Steel Corp. Fellowship, Mellon Institute; and as such are unusually well fitted to write on

the subject.

In the preface it is stated that the aim is to produce a book useful to businessmen and others outside the industry. Hence they start with a simplified yet accurate account of coal carbonization, its history, processes, products and trends. This is followed by classification of fuels with clear concise discussions of various fuels, and combustion explained in its simplest terms including chemical reactions, material and heat balances, and thermal chemical equations. Though simplified it would seem difficult for a layman to get much of a grasp of the large amount of material given.

The formation of coal, its elementary composition, classification, and petrographic constituents are well explained. The chemical constitution however would be hard reading for a layman, and the treatment is too brief to give much information.

The chapter on tests and factors in relation to characteristics of coal for carbonization; plasticity, bulk density, expansion and pressure, is well done; as is also that on crushing, screening,

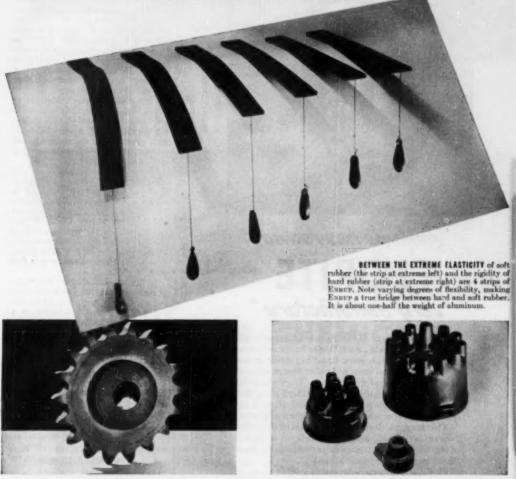
washing and storage of coal.

The construction and operation of coke ovens, including characteristics of refractories, have been made simple enough for the businessman, but contain a wealth of information for the fuel engineer. The discussion of the coking process in byproduct coking, its chemistry, products, plastic zone, temperature and pressure effects, heat requirements and balances, is very good, though on p. 172 aromatic structures with only three carbon valence bonds showing look queer.

The chapter on high temperature (Continued)

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coke, its chemical composition, physical properties and effects of coking conditions, contains an especially good section on utilization of this coke in blast furnaces, foundry cupolas, water gas sets, gas producers and as domestic fuel. Coke-oven gas; its collection and treatment in the plant plus conditioning to remove such impurities as, hydrogen sulphide, cyanides, naphthalene, nitrogen oxides and guin formers; its dehydration, storage and metering; is given a brief but clear and authoritative treatment.

Then follow three chapters in which brief but adequate discussion is given of ammonia and its salts including disposal of still wastes; light oils with some theory of scrubbing; and coal tar, its distillation and separation of the main products.

Under coal carbonization in gas manufacture horizontal and vertical retorts are described and compared in results with coke ovens. In another chapter the current low temperature carbonization plants, Disco, Krupp-Lurgi, and Hayes, together with a number of obsolete ones are described. In the same chapter is a good discussion of the Curran-Knowles sole flue oven.

In the two final chapters economics of coal carbonization, and its trends are discussed, with numerous tables giving data not usually available in a single place, and with a generally hopeful tone. In this discussion as well as throughout the book the authors are to be complimented for their use of factual data in tables and graphs to support statements in the text.

The text is well written, and should be on the reference shelf of anyone interested in fuels.

Substantial

REFRACTORIES. Third Edition. By F. H. Norton. McGraw-Hill Book Co., New York. 782 pages. \$8.50. Reviewed by G. J. Easter

Here's a substantial revision of a well known text. The former chapter on crystal chemistry has been omitted but directions are given for finding this type of material if desired. Several new chapters of timely interest have been added and practically all portions of the book rewritten and enlarged. Drawings and photographs are clearer than in the older editions. Several cost figures are still in prewar values but the statistics of the industry have been brought up-to-date (1946) in both dollars and tons. Unfortunately data on the important silicon carbide refractories industry are (Continued)









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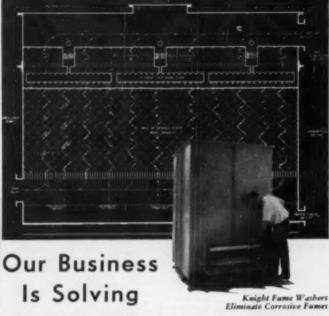
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BOOKSHELF, cont. . .

omitted. Bibliographies have been expanded and are well tied in with the text by number.

In the rewritten chapter on molding methods, theories as to the mechanism of workability are discussed and applied, particularly to slip casting. The relatively new methods of forming by hydrostatic molding and by hot pressing are described though vibratory pressing is not.

A new chapter relates to laboratory furnaces. The treatment of high frequency induction furnaces for laboratory use is unusually complete, covering both equipment and operating techniques. Discussions of other furnaces, both lab and plant, have been revised. Air preheaters and rotary calciners are newly included as well as the more orthodox kiln types.

There is an excellent new chapter on the newer high purity refractories which have come to be of special interest in relation to recent wartime developments. Not only metals and their oxides but silicates, zirconates, carbides, nitrides, borides, etc. (even refractory sulphides) are evaluated. The combined metal plus nonmetal materials (cermets) are mentioned but not in detail. Growth of large synthetic single crystals is covered.

All the regular methods of testing refractories are quoted in detail from ASTM and other tests—such as those for creep of refractory materials-are described where these seem of importance. There is a short but helpful discussion of the application of test results in furnace design. The effects on refractories of gases other than CO are discussed. Warning is given that certain refractories react with one another when hot although the table of permissible safe temperatures is not convincing in this connection. Thermal expansion data and emissivity coefficients are shown for an unusually wide range of materials. The section on particle size measurement would be improved by inclusion of tolerance limits as well as the nominal openings of sifting screens.

The chapters on the use of refractories have been rewritten to bring them up to date with several new pictures particularly in the boiler furnace field. Two new chapters of particular note relate to the as yet small volume application of refractories in nuclear power production and in gas turbines and jet propulsion. The first discusses clearly the principles involved in nuclear fission and the accompanying requirements of refractories for specific parts of prospective reactors. The second constitutes an unusually complete treatise on jet engines and

(Continued)

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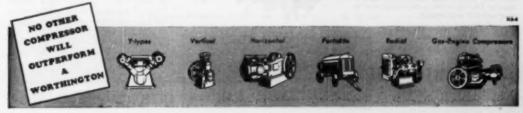
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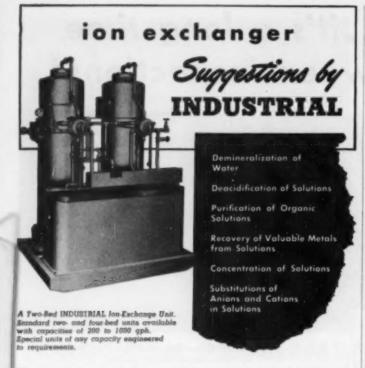
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DEMINERALIZERS

BOOKSHELF, cont. . .

rockets with discussion of the temperatures, fuels and mechanical requirements in this still largely undeveloped field.

In general, the index could be expanded to advantage. The book is readable and authoritative and warrants purchase by the worker in refractories even though he may already have an earlier edition.

Reasonable Success

AGRICULTURAL CHEMISTRY, Vol. I. (Principles of Agricultural Chemistry.) Edited by Donald E. H. Frear, D. Van Nostrand Co., New York, 812 pages, \$9.

Reviewed by W. B. Van Arsdel

In his preface to this first volume of a projected two-volume work, Dr. Frear, Professor of Agricultural and Biological Chemistry at Pennsylvania State College, says that his intention has been to collect an authoritative general reference text, written by men who are recognized specialists in their fields. The work is aimed at "serious students of the subject"-graduate level students, specialists engaged in agricultural work, such as county agents, extension workers, and technical employees of firms dealing in agricultural chemicals, and, finally, research investigators who need in-formation in helds bordering their own. The second volume is to be devoted to practical applications of the principles of agricultural chemistry.

The reviewer feels that Professor Frear has been reasonably successful in his ambitious and difficult undertaking. The volume under review will, indeed, be a valuable reference text for many persons in the categories he has named. As might have been expected, the authors have not all interpreted the purpose of the work in the same way; the result is a wide variability between chapters in the degree of specialization presupposed in the reader. A few, for example the chapters on utilization of carbohydrates and nitrogen compounds in plants, will be found difficult by specialists in closely related fields. A few others, such as the chapter on energy metabolism in animals, can be understood at the senior undergraduate level. Most of the chapters are written with the reference purpose foremost. More than 1,800 references to texts or research papers are cited in the bibliographies, one of which follows each chapter.

The volume is organized into five parts: Some fundamental materials and processes common to plants and (Continued)



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BOOKSHELF, cont. . .

animals; chemical processes of fundamental importance in agriculture; plant chemistry; animal chemistry; and soil chemistry. Some overlapping and duplication occurs, as was inevitable. The mechanism of carbohydrate metabolism is discussed, for example, in three of the chapters, although from somewhat different viewpoints. On the other hand, the boundaries of the domain of agricultural chemistry are never very rigidly defined. At one extreme is a discussion of the biophysics of cell growth; at the other, a distinctly practical review of some problems in animal hus-bandry. The reviewer feels that Professor Frear was wise not to insist on too rigid a definition. Relationships across boundaries are too often ignored by the specialists on both sides. While many of these chapters are beautifully lucid, some of the authors have not had the forbearance to write for the miscellaneous audience defined in the preface, but have essentially written review articles for scientists within their own clans.

On the whole, the work is an excellent summary of the state of knowledge in its field as of late 1948. A few references to 1949 publications appear in the text. The standard of typography and editorial vigilance is uni-

formly high.

Reference

LANGE'S HANDBOOK OF CHEMISTRY. Seventh edition. By Norbert A. Lange. Handbook Publishers, Inc., Sandusky, Ohio. 1934 pages. \$7.

Here is the mixture as before, judiciously laced with revisions, extensions and additions. Speaking broadly, the book again gives vital statistics, in tabular form, on the elements, inorganic and organic compounds, analytical and physical chemistry, and industrial chemistry. Into the last category fall materials of construction, alloys, ceramics, wood, wire tables, sieves and screens, hazardous chemicals, humidity tables, tank capacities, densities of solutions, industrial water, fuels, manufactured and natural gases, steam tables, cooling baths.

The table of isotopes, for one, has had a complete overhauling. The periodic chart, description of the elements, plastics and synthetic rubbers, composition and use of foods, corrosion and heat resistant alloys are among those tables substantially changed to keep up with current developments.

New features include tables on glyceride content of drying oils, prop-(Continued)

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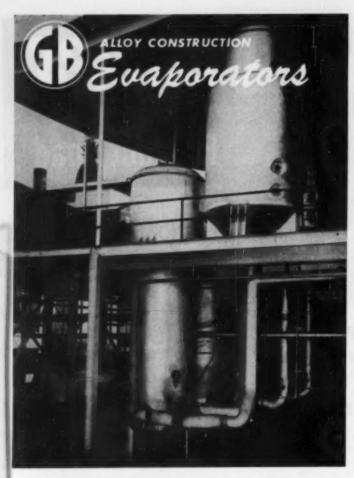




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BOOKEHELF, cont. . .

crties of hormones, ASTM classification of coals by rank, dielectric constants, dipole moments and logarithms of equilibrium constants. To
make room for these without greatly
upping the size and price of the book,
the compiler has left out some of the
mathematical data which appeared as
an appendix in the previous editions.

—FA

Not Above Reproach

DATA BOOK ON HYDROCARBONS. By J. B. Maxwell. D. Van Nostrand Co., New York. 259 pages. \$5.

Reviewed by W. H. B. Geoghegan

The preface to this book states that its "primary purpose . . . is to provide (1) basic data on hydrocarbons and petroleum fractions, (2) methods of applying these data to process engineering, including illustrative examples and some fundamental theory, and (3) applications of a few of the unit operations of chemical engineering used extensively in the petroleum industry."

The scope of this volume may be shown by an enumeration of its four-teen major sections: physical constants, characteristics of petroleum fractions, molecular weight, vapor pressure, fugacity, critical properties, thermal properties, density, viscosity, combustion, flow of fluids, flow of heat, equilibrium flash vaporization, fractionating towers. Included at the end are a table of conversion factors

and an index. Taking the book as a whole, it may be said that the author has achieved his stated purpose. Data in the various sections are presented chiefly in the form of graphs, and as a result a very large amount of information has been packed into the book's 259 pages. In each section the actual presentation of data is preceded by a short discussion explaining the use of the charts, and including a list of references. The author has been quite scrupulous in defining the limits and conditions within which the data may be applied, and, where necessary, in outlining the background of his correlation methods. This feature is very valuable in a presentation of this type, in which a considerable portion of the information has been arranged by empirical or semi-empirical methods, and may not necessarily be extrapolated freely.

As a practical collection of engineering data on hydrocarbons, the book is unequalled in scope by anything previously seen by this reviewer. It is strictly an engineering work. The (Continued)

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BOOKSHELF, cont. . .

charts, all quite legible, are constructed to be read with accuracy to match slide rule calculations, and where precise and necessary data are lacking, various empirical devices have been employed to supply them.

One feature not to the liking of the reviewer is the almost uniform use of atmospheres as the unit of pressure. While this no doubt has a certain simplicity in some thermodynamic usages, it is not an engineering unit generally employed, and the use of the charts plotted in atmospheres requires either a considerable amount of conversion of units, or else the adoption of calculation methods to fit this particular book.

Sections 11, 12, and 14 are considerably less impressive than the rest of the volume. The subject matter in them has been much compressed, and although many routine problems might be solved, or approximately solved, by their use, they do not constitute a reference section suitable for extensive design work. Radiant heat transfer, for example, is sketchily covered by one graph of black body radiation as a function of temperature up to 700 deg. F., accompanied by an emissivity table. The section on fractionating towers is a highly condensed treatment almost in the nature of a "refresher." The practical and essential step of translating theoretical steps into actual fractionating plates is covered only by Gunness' data of 1936, and no mention is made of more recent work which has shed additional light on this difficult problem, such as that of Drickamer and Bradford and of O'Connell.

Physically the book is well arranged and legible. The index is straightforward and reasonably complete. The checking seems to have been well done, as typographical errors are few.

The verdict: a book which will be extremely useful to any engineer whose work deals with hydrocarbons, and which, though not above all criticism. represents a good practical realization of the author's purpose.

Opinions

THE CEMISTRY OF INDUSTRIAL TOXICOLOGY. By Hervey B. Elkins. John Wiley & Sons, New York. 406 pages. \$5.00.

Reviewed by H. H. Fawcett

Entirely different in its approach from the several other excellent books which have appeared on industrial toxicology in the past few years, this (Continued)



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BOOKSHELF, cont. . .

work is a valuable addition to the literature. Elkins is chief of laboratory, division of occupational hygiene, Massachusetts Department of Labor and Industries; chairman, committee on standard methods, American Conference of Governmental Industrial Hygienists, and member at large, Z -37 section committee on maximum allowable concentrations of toxic dusts and gases, American Standards Association. These contacts have given him a wealth of data, as well as strong opinions on the toxic effects of many chemicals.

The five major divisions of the book are: (1) brief discussions of elements. compounds and mixtures as to the nature and degree of their hazard without going into the details so characteristic of other books (153 pages); (2) preventive measures and review of industrial processes which create health hazards (32 pages); (3) de-tailed discussion of maximum allowable concentrations, in which the author describes why he feels his values are more nearly accurate than other quoted figures, (31 pages); (4) analytical methods and sampling procedures for commonly encountered hazards, based largely on the Massa-chusetts Division of Occupational Hygienc methods (128 pages), and (5) a bibliography with 366 references, followed by an index of 12 pages.

All through the book, the author's opinions and feelings are plainly stated. Also, the general concept of writing for chemists, chemical engineers, and plant supervision is carefully followed. Without question, the author has rendered a valuable service to industry, and the book is recommended without qualification. It is a very valuable "handbook" to the art and science of industrial hygiene, and should find a place in every industrial plant and technical school library.

93, 94, 95 and 96

THE TRANSURANIUM ELEMENTS, Parts 1 and 2. Edited by Glenn T. Seaborg, Joseph J. Katz, and Win-ston M. Manning. Mc-Graw-Hill Book Co., New York. 1,733 pages. \$15 for both parts.

Reviewed by J. Malcolm Miller

The two books to be reviewed here are a part of the National Nuclear Energy Series. This series is expected to be composed of approximately sixty volumes that will contain reports and reviews describing declassified research performed under the auspices of the Manhattan Project and the Atomic Energy Commission. "The Trans-(Continued)

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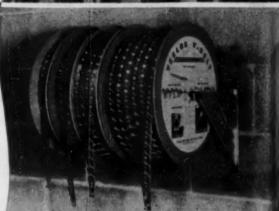
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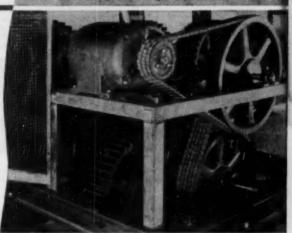
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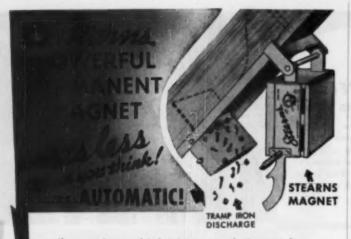




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uranium Elements," parts 1 and 2, are volume 14-B of Division IV (Plutonium Project) of the eight divisions into which the National Nuclear Energy Series is to be grouped. The volumes of division IV are apparently to consist of "A" and "B" volumes; the former to be be of a general survey and review nature, while the latter will contain the many reports that serve to document the "A" volumes.

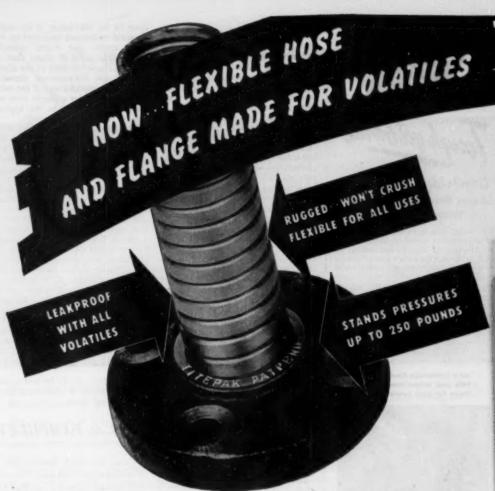
"The Transuranium Elements," in

"The Transuranium Elements," in 162 papers, describes part of the research of some one hundred and ten investigators at the Department of Chemistry and the Radiation Laboratory of the University of California, Chemistry and Physics Divisions of the Metallurgical Laboratory of the University of Chicago (now the Argonne National Laboratory), Department of Chemistry and the Institute of Atomic Research of Iowa State College, Clinton Laboratories (now the Oak Ridge National Laboratories), and the Department of Physics of Washington University at St. Louis.

The majority of the papers pertain to the discovery, isolation, and chemical and physical characterization of the element 94, plutonium, and its compounds. There are also a few papers on the investigation of the nuclear characteristics of plutonium isotopes. Approximately twenty reports are devoted to these same aspects of element 93, neptunium. The investigations of neptunium reported here, however, were carried out when the pressure on the various laboratories had apparently lessened somewhat and hence this relatively small number of papers nevertheless describes the results of a well-planned program to unravel the chemistry of neptunium and leaves the basic chemistry of this element in somewhat better condition than that of several of the more common elements. Approximately ten papers are concerned with the discovery, tracer chemistry, and preparation and investigation of microgram quantities of americium and curium. There are also about ten papers on instrumentation and techniques, most of which are instructive and pertinent.

Since this volume is intended primarily to be a documentation of survey volumes, it contains no critical reviews of the great mass of data presented. It is unfortunate that probably for the same reason there is no subject index. There are, however, several author lists, one of which includes recent addresses.

With very few exceptions, each of the papers in this volume is of a caliber requisite to publication in an appropriate journal of the open literature (Continued)



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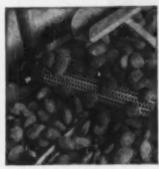


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both with respect to scientific content and method of presentation, although some of the articles at this time are primarily of historical interest and the results presented have since been superseded by more recent and complete investigations. To the best of the reviewer's knowledge in all such cases the more reliable data have been carefully indicated. By the inclusion of superseded data, however, this collection of papers achieves a coherent presentation of the growth of information on the transuranium elements from most of the first experiments indicating their existence, through the tracer studies on the micro-microgram level, through the impressive investigations with microgram quantities, up to the experiments with macro amounts. It is partially this attribute of the collection of papers that makes it of significance to others besides the specialist in radiochemistry. Indeed from a purely pedagogical standpoint, we have here in one collection a fairly complete description of both the classical and modern methods for studying the inorganic and physical chemistry of an element and its compounds.

"The Transuranium Elements" is of great value to the radiochemist not only because of its description of the inorganic and physical chemistry of these artificial elements, but also be-

cause of the description of the radiochemical techniques employed on the trace, micro, and macro quantity levels. The series of papers that report the characterization of the chemistry of the transuranium elements when only concentrations of the order of 10⁻¹⁰ molar were available is an important contribution to the application of "trace level" chemistry.

The techniques and the results described for the investigation of the solution chemistry of plutonium, and in particular of the equilibrium among the ionic species present in solutions, should serve both as a guide and a stimulus to the gathering of similar data for many of the more common but neglected elements.

These papers are no doubt only a small part of the large number of reports on the transuranium elements written under the Manhattan Project or the Atomic Energy Commission. This is made evident by the fact that many reports referred to in this collection are designated by that mixture of letters and numbers that represent volumes not often found in a library outside the government archives. The impression is gained, nevertheless, that here we have at least the more pertinent and representative of the declassified documents on this subject.

The editors are to be commended and thanked for a difficult but necessary task well done.

RECENT BOOKS & PAMPHLETS

Reports. "Bibliography of Technical Reports." Reports from civil and military agencies of the United States and from cooperating foreign governments are listed in a monthly beokiet for the benefit of science and industry. Contains sections on chemicals and allied products, electrical and libricants. It per year, U. E. Department of Commerce, Office of Technical Services, Washington 25, D. C.

Engineers. "Engineers Offer New Frontiers." Need for engineers in positions, especially in small businesses, where they are not commonly employed. 8 pages. American Society for Engineering Education, Division of Relations with Industry, c/o &. B. Brownwell, Northwestern University, Evanston, Ill.

Fire. "Organising Your Plant for Fire Safety." How fires start and how to prevent them, why automatic sprinklers are needed and how to maintain them, types of extinguishers and extinguishing systems. \$1 pages. \$2. Factory Mutual Engineering Division, 184 High St., Boston 10, Mass.

Steam Hook-Ups. When and where steam traps or temperature control should be used, what types to select, how correctly to size and install them. Hook-ups and equipment are illustrated. 46 pages. Gratis. 6th edition, Sarvo Co., Empire State Bidgs, New York 1, N. Y.

Mechanical Engineering. "Kent's Mechanical Engineers' Handbook." Two volumes. One on "Design and Production" covers selection of materials, design principles, design and selection of machine components, production processes, production plant equipment. Includes working formulas, charts and tables; standard discountered to the production of the producti

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Business Cysics. "Statistical Indicators of Cyclical Revivais and Recessions." Study of the period up to 1938. By G. H. Moore, 95 pages. \$1.80. Occasional Paper 31, National Bureau of Economic Research, 1819 Broadway, New York 23, N. Y.

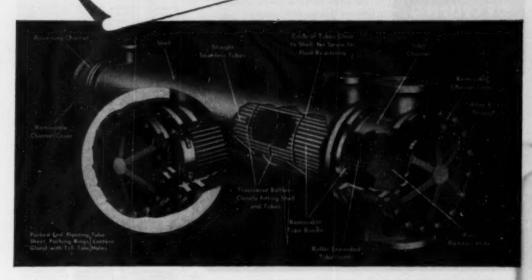
Air Polletion. "Industrial Wastes, 14th Annual Meeting." Eleven papers cover the chemical, engineering, meteorological, legal and health aspects of the subject. 116 pages. #2. Transactions Bulletin No. 12, Industrial Hygiene Foundation, Melon Institute, 4400 Fifth Ave., Pittsburgh 13, Pa.

Water Pollution. "Guide to Source Material on Water Pollution Control, May 1956." 39 pages. Gratis. Federal Security Agency, Public Health Service. Division of Water Pollution. Control, Washington 25, D. C.

Methyl Ethyl Retose. Commercial applications with emphasis on surface contings. Other applications discussed include adhesives, cleaning compounds, syes and insecticides, use in mineral off refining

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and colvent extraction. 130 pages. 2nd edition, Shell Chemical Corp., 36 West 50th St., New York 20, N. Y.

Leber. "New York State Disability Benefits Law." Text of law, outline of major previsions, topical index. 55 pages. New York State Workmen's Compensation Board, State Office Bldg., Albany, N. Y.

Pacific Northwest. "Major Industrial Potential of Snohomiah County, Wash." Survey of raw model and the Sursupply and transportation facilities, and population. Maps. tables, photographs. Outlines some specific areas of passible industrial development. By lyan Bloch. 136 pages. Snohomish County Public Utility District, 2030 Colby Ave., Everett, Wash.

Ceal. "Hydrogenation Studies on Midlothian Coal." By Fred W. Bull. 12 pages, 26 cents. Engineering Experiment Station Series No. 74, Virginia Polytechnic Institute, Blacksburg. Va.

Society Journal. "Journal of the Imperial College Chemical Engineering Society, 1948." Twelve papers cover such subjects as liquid-liquid extraction, valves for process plant, mixing, design of gas lift pumps. 207 pages. Imperial College Chemical Engineering Society, Chemical Technology Bids., Prince Consort Rd., London. & W.7, England.

Research. "Management of Industrial Research." An annotated bibliography propared from the viswpoint of the research director. 14 pages. Gratis. Arthur D. Léttle, Inc., Memorial Dr. at Kendall Sq., Cambridge 42, Mass.

Research. Picture presentation of the facilities for research at Georgia Tech in such fields as chemical, mechanical and biological engineering and physical and organic chemistry. 36 pages. Gratis, Georgia Institute of Technology. State Engineering Experiment Sta., Atlanta, Ga.

Mobilization. "Industrial Mobilization Program." A new manual to guide the military departments, other government agencies and industry in coordinated planning for the production of materials which would be needed for war. 15 cents. Munitions Board. Manual No. 46-1, Superintendent of Documents, Washington 25, D. C.

Coal Hydrogenation. "Hydrogenation of Petroleum and Lignite Tar Distillates." A report of the laboratory investigation in the vapor-phase section the Coal Hydrogenation. Demonstration Plant at Louistana, Mo. Mimeographed. By E. A. Clarko. Bureau of Mines, R.I. 4676, Superintendent of Documents, Washington 25, D. C.

Explosions. "Report of Research and Technologic Work on Explosives, Explosions, and Flames Fiscal Year 1942."
A summary of the experimental results and some indication of continuing programs now in progress. Mimographed. By Bernad Lewis. Euroau of Minos. E.L. 1917, Super-intendent of Documents, Washington 25, D. C.

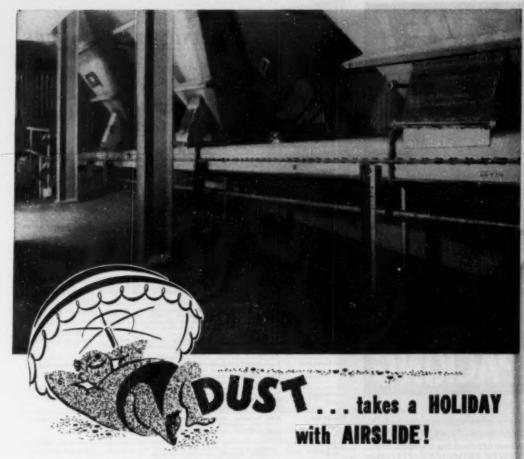
Handbook on Acrosols. Chapters from the Summary Technical Report of Division 10, National Defense Research Committee. 60 cents. Atomic Energy Commission, unnumbered document, Superintendent of Documents, Washington 26, D. C.

Trade. "Operation of the Trade Agreements Program." Present status of trade agreement negotiations and plans for tartif adjustment. 25 cents. U. 8. Tartif Commission, Report No. 163, Second Series, Superintendent of Documents, Washington 25, D. C.

Nickel Allays. Compilation of present knowledge with literature references. 50 cents. National Bureau of Standards, C495. Superintendent of Documents, Washington 25, D. C.

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Pumps 222D	Cycloidal vacuum pumps for paper mills. Installation views, construction and operating data. 12 pages. 30-B-13.	Roote-Connersville Blower Corp.
Rossomizers 828E	Cast iron tube and steel tube economisers. Tube arrangement, streamline flow of gas and soot blower steam are shown. 8 pages. 160.	Grass Fuel Economi- ser Co.
Valves 325F	Construction features, outaway drawings showing dimensions of a line of sampling valves available in a variety of alloys and materials. 4 pages. 4.	Alloy Steel Products Co.
Hose 822G	Design, construction and rubber compounds of air bose with rayon cord caream. Envelope size bulletin. 4 pages. 130.	Hewitt-Robins Inc., Howitt Rubber Divi- sion.
Piping 82311	Charto, tables, graphs, condensations and discussion of pips specifications, metallurgical welding data, design formulas. Section on working pressures, stress values and pressure ratings. Protonia index of line of fixings. Hard cover, 184 pages. 48.	Midwest Piping & Supply Co., Inc.
Insulation A222	Vinyl system, applied with a spray gun, for protecting and reinforcing thermal insulation. Plotures show uses and methods of application. 4 pages. G-103.	Insul-Martic Corp. of America.
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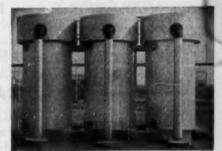
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Pempa SSAA	Contribugal pump with concentric casing. Large labeled drawing shows parts. 8 pages.	Mission Mfg. Co.
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Materials Handling 324D	Filling and dispensing equipment for adjustable displacement, minute quantities, corresive liquids, velatile liquids, 4 pages. SM-9505,	% Properticueurs, Inc. %
Rotary Pumps 334E	Illustrates design, construction, maintenance, operation and application. Details of sliding vance and swinging vance with selection table for specifying. 6 pages. 307	Blackmer Pump Ca.
Water Conditioning 324F	Current status of embrittlement, its esuase and control. Developments include use of nitrates as inhibitors, use of detector unit. 4 pages. 45.	Allis-Chalmers Mfg. Co.
Adkasivos 334G	Review of the development and present practice, both German and American, of isocyanate-based adhesives. Properties of two difeocyanates available. 14 pages. P-148.	Monanto Chemisal Co.
Chierine 334H	Thermodynamic properties of chlorine in graph form, printed in two colors on heavy-crated stock, 24 by 11 in Clivus heat content of liquid, of saturated gas and of super-heated gas in the temperature range of -40 to 500 dag. F. at 15 to 1100 psf.	Diamond Alkali Co.
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Chemical Economics

RICHARD F. WARREN, Market Editor

Heavy Demand Keeps Chemical Consumption High in Most Consuming Industries

Chemical consumption—along with general business—seems to be running well ahead of even the most optimistic forecasts. March consumption of industrial chemical Engineering's Index of chemical consumption soared to 255—this was more than 12 points above the previous high reached in 1948. In April the index stood at 248.—Preliminary data for May and June point to a continued high operating level in those months.

The tremendous demand along with other inflationary influences has set off a chain reaction in many basic chemical prices. This reaction has been spreading as producers of intermediate chemicals felt the impact of rising costs and in turn increased prices. Among the chemical prices that rose during recent weeks are carbon tetrachloride, chlorobenzene, phenol, aniline, styrene, and ethyl alcohol, soda ash and chlorine. While solid caustic prices rose, the announced hike in Solvay's liquid caustic was annulled.

The boom has pushed demand ahead of production in the pulp and paper industry. As a result, pulp and paper prices have moved upward. Paper production in June was about 102 percent of rated capacity. Board operations were almost 95 percent of rated capacity.

Textiles have also responded to the rush of business and chemical use in textiles jumped forward again in May. It is running well ahead of the corresponding 1949 monthly rates. The jump in textile chemical operations is viewed with pleasure by the dve industry which had a real slump in 1949 compared with 1948 operations. Data released in June shows that sales last year dropped to 136 million pounds (production was 139 million pounds). Sales in 1948 reached 187 million pounds. The 1949 dip in output extended to all major chemical classes of dves. Azo, anthraquinone vat, indigoid, and sulphur dves followed the general trend. Nevertheless, textile chemical producers are not riding on any gravy train. In testimony before the chemical panel of the Committee for Reciprocity Information, George W. Russell of the American Cyanamid Co. pointed out that proposed tariff cuts will make domestic production of potassium and sodium ferricyanide unprofitable. He blamed the competitive advantage of imported ferricyanides on (1) the 50 percent tariff reductions granted in 1948, (2) socialized production abroad and (3) low foreign labor costs. He stated the domestic producers needed a boost in tariffs rather than a reduction and recommended a return to the pre-1948

Tariff duties on chemicals have been the subject of considerable discussion in recent weeks. This is due to coming international trade negotiations. Many chemical executives have pointed out that devaluation of the foreign currencies has had a serious effect on our world trade in items such as chrome chemicals. Before the war we supplied Britain, Australia and India with chrome products, but we have lost 70 percent of our export trade on these items. Here, too, low labor costs and devalued currency have worked against domestic output.

Two sodium hydrosulphite producers were among the chemical firms arguing for the retention of the present tariffs on that chemical. They pointed out that British producers were receiving an indirect subsidy by government regulation. One producer claimed that his firm had lost all foreign markets for this chemical since the end of the war.

Steel industry has been doing its share in keeping the chemical business busy. For the past three months the consumption of chemicals in iron and steel has been running at a record level. Late in June the steel industry had turned out 19,230,000 tons in a ten week period. This is an all-time record. The present cycle of more than 100 percent operations started in April and has been maintained through June.

Other process industries adding impetus to current activities are fertilizers, paint and varnish, industrial explosives, petroleum and coal chemi-

The current boom is not confined to the chemical consuming industries. According to a report from the National Association of Purchasing Agents, general business had reached a high point for the year at the end of June. Purchasing agents report that June held the advances made in May and business moved substantially higher in terms of production and new orders. Much of this increase was in anticipation of July's industrial vaca-tion shut-downs. Inventories have continued to increase, however turnover is reported to be improving and is considered satisfactory. Some industries are finding production is unbalanced by slow delivery of hard-toget materials. With employment at its highest point for the year, another encouraging note is sounded. Employee productivity is improving significantly.

General feeling is that business will hold at its present high levels throughout most of the third quarter. As the international situation remains tense, considerable activity on military items is coming. This too will push chemical consumption along at very high levels. Even without the war stimulant, however, it begins to look like 1950 will challenge the all-time 1948 records.

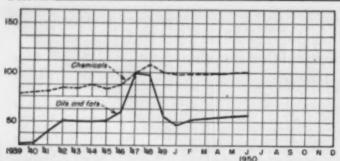
Price Trends

As mentioned earlier, the price trends for chemicals was upward again last month. Chemical Engineering's chemical price index rose to 102.31 by July 1. However, the fats & oils index dropped off during June. By the first of the month it was down to 54.45—a drop of two full points from the June 1 level. But some fats and oils ran counter to the trend.

With many prices showing an inflationary trend, buyers are taking as short a view of future coverage as is possible. Nevertheless, it is necessary to support production schedules and allow for increased procurement leadtime for many materials needed to keep plants humming.

PRICE, CONSUMPTION AND PRODUCTION TRENDS

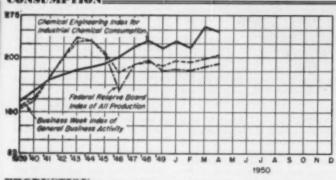




Chemical Engineering's Price Index a month, a year, and two years ago

									Chemicala	Oils & Fat	
As of	July	1	l.						102.31	54.45	
	month									56.45	
July	1949 .	×		'n	8	'n.		*		52.74	
July	1948 .	0		0		0	0	0		111.46	
									19	47 = 100	

CONSUMPTION:

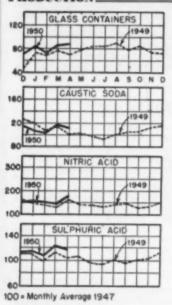


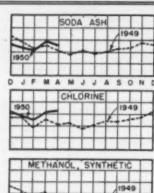
Chemical Engineering's Consumption Index for Industrial Chemicals

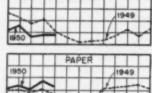
(A breakdown by consuming industries)

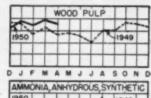
	March (Revised)	April
Fertilizers		62.25
Petroleum refining	21.60	20.25
Paint and varnish	24.20	24.28 15.08
Rayon	29.76	27.70 10.17
Coal products	9.19	10.61
Explosives	7.94	8.16 5.85
Plastics	-	15.02
INDEX	255.04	248.03 = 100

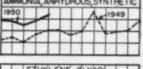
PRODUCTION =

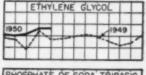


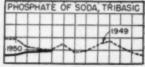


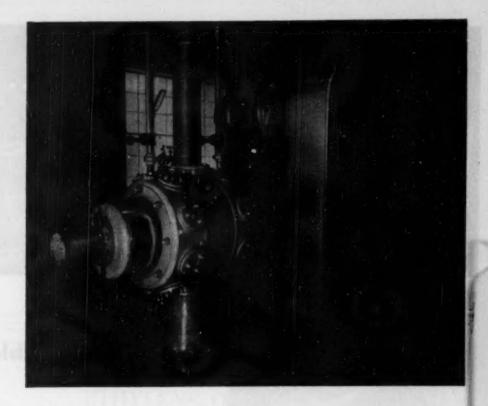












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Top photo—CMH REX-TUBE Type RT-15 being used to steam out a storage tank. Middle photo—CMH REX-TUBE Type RT-15 used as a gas connection for a furnace. Bottom photo—CMH REX-TUBE Type RT-15 used for unloading a tank car.

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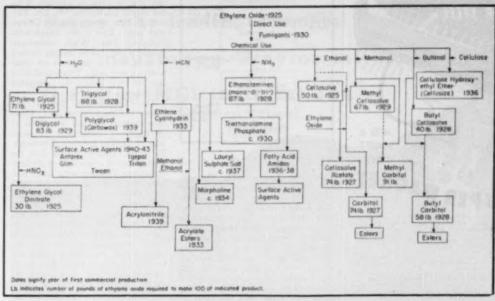


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Commodity Surveys

ETHYLENE OXIDE

Basic raw material of many organic chemicals, its output doubled in the past two years. More is coming.

JOHN R. SKEEN, Director of Market Research, Foster D. Snell, Inc., New York, N. Y.

Ethylene oxide is an unsual chemical. Production capacity more than doubled within the last two years and probably will soon become 600 million pounds. The chemical is characterized by one dominant outlet—about 60 percent contributes to the antifreeze market. While there will be six producers in the near future, present stature—almost that of a heavy chemical—is attributable to the pioneering of a single company. Carbide and Carbon Chemicals Corp.

Ethylene oxide is highly reactive. The glycol series is obtained upon combining with water. With alcohols, the important glycol ethers and esters result. The ethanolamines and ethylene cyanhydrin derive from the addition of ammonia and hydrocyanic acid. From these four generic reactions come a long list of chemicals with many uses: anti-freeze, textile fibers and finishes, explosives, Buna-N

rubber, surface active agents, solvents, plasticizers, hydraulic fluids, dyes, to-bacco, cellophane, corrosion inhibitors, and others. The glycols are of greatest importance. They represent nearly 80 percent of the oxide and have the widest industrial distribution.

Until last year there was insufficient oxide to supply the demand. While this affected most industries, the situ-

Ethylene Oxide Producers

	Operating Dates	Promo
Carbide & Carbon Chemic	ale Coro.	
South Charleston, W. V.	1996	Chlorination (1928) Oxidation (1937)
Torse City, Tor.	1941	Oxidation
Whiting, Ind.	1951	Oxidation
Chicago Cura. ²		
Corosa Christi, Tox.	1961	Oxidation
Dow Chemical Co.		
Midland, Mich.	19884	Chlorination
Freepart, Teg,	1941*	Chlorination
Jefferson Chemical Co.		
Purt Neches, Tex.		Chloropology
Mathieson Hydrocarboe C	hemical Co.	
Brandenburg, Ky.	1951	Chloropating
Wyandotte Chemicals Con	A	
Wyandette, Mich.	1049	Chlorination

¹A combinating of Chinago Corp., Funtiae Reflaing Co. Curthage Hydronal and two others. Swindir production *Late 1941 or early 1942. *Preduction in the ratio of two meta articles make and man text convolues code. ation was especially evident in the amount available for glycol anti-freeze. Normally this share is about 60 percent of the total oxide equivalent made. It was reduced to 40 percent and, so far as the civilian supply was concerned, less during early war years. Recovery has been slow.

There are several reasons for this, closely related to production requirements. Until 1937 ethylene oxide was made commercially only by reacting hypochlorous acid with ethylene. The resulting chlorohydrin is neutralized by milk of lime and the oxide recovered by successive fractionations. This procedure offers several advantthe high-purity product may readily be converted into many deriv atives, equipment costs are relatively low, and the process is efficient. A practice common to later producers is to convert the chlorohydrin immediately to ethylene glycol and co-product, without isolating the oxide. second process, operated first in 1937 consists in reacting a large excess of air with ethylene by means of a variously activated silver catalyst. Again, the product may be recovered as oxide or glycols. The catalyst is inexpensive and saves nearly all of the chlorine charges. However, the conversion of ethylene is around 50 percent and equipment costs have become high in comparison with the other method.

For many years, production was (Continued)



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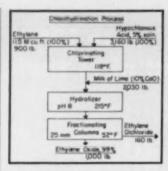
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COMMODITY SURVEY, cont. . .

based upon chlorine alone. The periodic inadequate supply often prevented full operation of oxide capacity even in the 1930's. In part to circumvent this handicap, an oxidation unit was put in operation at South Charles-ton. With the coming of war the demands of the armed services for glycol and allied compounds soon appeared. Of the new oxide capacity of 50 million pounds then installed, almost all avoided chlorine, and only lately has there been sufficient to achieve maximum yields from the oxide facilities available. Instead of expanding production, the civilian supply was minimized, i. e. practically eliminated. The continued scarcity of chlorine was a major factor in delaying the construction of new plants.

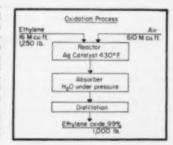
Expansion began in 1948, when Wyandotte Chemicals Corp. and Jefferson Chemical Co. began production by the chlorination process followed by an increase by Dow Chemical Co. at Freeport. Last year Carbide installed additional oxidation units at South Charleston and Texas City. It was thought that this was sufficient. However, capacity of perhaps 150 million pounds more is expected in 1951. Most will be contributed by two new producers, Mathieson Hydrocarbon Chemical Co. and Chicago Corp.

This apparently belated expansion is predicated upon continued optimism respecting the anti-freeze market as well as new developments. In the latter category the polyethylene oxide detergents and emulsifiers promise significant growth in the household and industrial field. Probably 10 million pounds of oxide will soon be so required. The ethanolamines appear to gain in favor as absorbents for such acidic gases as hydrogen sulfide and carbon dioxide. At least two producers plan an additional supply as soon as possible. The largest markets are offered by the new textile fibers. Thus, from acrylonitrile come Orlon and Fiber A of E. I. du Pont de Nemours and Co., and the Vinyon N

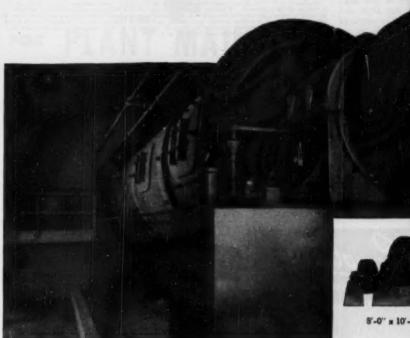
and Dynal of Carbide. Plants will be operating this year at Camden, S. C. and South Charleston, W. Va. Further, du Pont expects to make Delvon next year. This is the terephthalic acid-glycol fiber. While conjectural, prospects are that 50 million pounds of oxide will be consumed for these materials very soon. This is said to be only the start. If true, the anticipated facilities will be needed.

The chlorohydrin process was known to Carius before 1863. Commercialization was an outgrowth of investigations undertaken 50 years later at Mellon Institute, Pittsburgh, Pa. Here, George Curme laid the foundations of a new field of aliphatic chemistry. Together with James Rafferty, the work was continued upon the formation of Union Carbide and Carbon Co. in 1917. Within a short time, ethylene oxide and glycol as well as a long list of allied chemicals derived from petroleum were shown to have commercial promise. Accordingly. Union organized Carbide and Carbon Chemicals Corp. in order to prosecute this work. To this end, the responding to this work. To this end, the natural gas station of the Clendenin Casoline Co., W. Va. was immediately acquired and pilot operations began in 1920. These soon showed that profits could only be expected from large-scale production and the project was moved to South Charleston, W. Va. five years later. Ethylene oxide, glycol and Cellosolve were first made. The Carbitols soon appeared together with butyl Cellosolve, and markets were found for di- and triglycols. This group of compounds exhibited the most rapid growth of all of Carbide's chemicals. Within 10 years after initial production, chlorine requirements exceeded 300 tons per day, nearly a third of the domestic supply. This factor became a handito attaining full production. While still true, the chlorine process nevertheless accounts for nearly threequarters of present oxide output.

The partial oxidation of ethylene with oxygen was announced by Reyer-son and Swearingen in 1928. Three years later T. E. Lefort obtained a (Continued)



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French patent assigned to the Societe Française de Catalyse Generalisee. The catalytic oxidation procedure was claimed. The corresponding domestic patent was acquired by Carbide and became the basis of subsequent production. Carbide remains the only operator of this process although the Chicago Corp. plans comparable facilities for next year.

With over half of the supply, Carbide is still dominant in this field. Next in importance are Dow and Jefferson Chemical Co. The output of Wyandotte is relatively small.

Ethylene Oxide Capacity¹ in Million Lb.

	Camazitar		Chlorination-			-Oxidation-	-
	(Total)	Capacity	Producers	Plants	Capacity	Preducers	Plants
1931	Beste	300			908	2	4
1980	440	230	4		130	1	2
1940.	440	330	4	5	130	1	2
1948	302	242	4	8	60	1	2
1947	301	3-43		3	60	1	2
1946	201	143	9		- 66	1	12
1945	201	141	9	3	60	1	2
1944	-301	141	2	3	60	ì	2
1943	301	141	3	3	60	i	2
1942	301	141	2	3	60	1	2
1941	198	133	2		60	1	2
1940	148	133	2	2	1.5	î	1
1939	148	133	2	2	15	1	i.
1938	1.55	140	1	i	1.5	-1	1
1937	130	115	1	1	15	1	1
1936	115	115	1	1	0	0	0

Exclusive of du Pont glycol production deriving from HCHO; all citad include ethylene oxide, pone well as glycol equivalent. Capacity frequently quoted at 759 million pounds and several estimation million pounds and several estimation of the production of the production of the product of th

Ethylene Oxide Consumption in Million Lb.

			Oly	cols				Other Chemicals			
			Ethyleo	e Glycol		,	Pot 4	Other Chomasan	~ *		Anti-Freeze
1000	Total	Sub-total	Direct Uses	Chemical	Others	Sub-total	Cyanhydrio ⁴	Ethanolamines*	Ethers	& Misc.	% of Total Oxide
1849	413 364	27%	203	19	24	78	-	28	24	11	60
1947	197	180	118	16	16	47	13	15	16		- 55
1945	163	125	98	13	14	22	11	12	14	1	44
1943	171	130	104	12	18	41	16	10	14	1	28
1940	128	104	79 76	11	14	24 18	2	10	11	1	58.
1939	108	94	78	9	10	14	0	6	8	1	60



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- Safe and easy to use Convenient hand-form "D" handle. "Safety First" trigger throttle. Easy hole starting - on partial feed position.
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Gardeer-Deover Company, Quincy, Illinois.
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Proposed Work

- Cons., Wethersfield—Rourke-Eno Paper Co. 58 Allyn St., Hartford, plans to construct a 1 story, 100x500 ft. warehouse and office building on Blas Deane Hy. Estimated cost will exceed \$6,000
- Idaho, Moscow—Idaho Clay Products, Inc., Moscow, plans to construct a brick manufacturing plant. Estimated cost #150,000
- Ind., Newport—U. S. Atomic Energy Comm., 76 Columbus Ave., New York, N. Y. pians to construct a pilot plant for chemical processing at the Wahash River Ordnance Works in Vermillon Co.
- La. Blanchard—Arkansas-Louislana Gas Co., Slattery Bldg., Shreveport, plans to construct a gas compressor station. Butimated cost \$456,000.
- Mich., National City-National Gypsum Co., 285 Delaware Ave., Buffalo, N. Y., plans to construct warehouses. Estimated cost \$590,000
- N. Y. Brooklyn—Presto Plastics, Inc. 5216-24 Avenue U. plans to alter its factory here. Charles M. Spindler, 184 Montague St., Archt. Estimated cost \$100,000
- O. Cleveland—American Gas Assn., 1022 East 62nd St., plans to construct a 2 story, 169x125 ft. addition to its laboratory and office. Coborne Engineering Co., 7016 Euclid Ave., Archt. Estimated cost \$275,000
- O. Lancaster—Anchor Hocking Glass Co., 109 North Broad St., plans to construct a 1 story, 150x275 ft. research laboratory building.
- Okla., Ada—Ideal Coment Co., Ada, plans to increase the capacity of its plant here from 1,600,000 bbl. to 2,750,000 bbl. Estimated cost \$1,000,000
- Okla., Yaie—Phillips Petroleum Co., Bartleaville, plans to construct 281 mi. 10-in. oil pipe line from Borger, Tex., to Yaie. Estimated cost \$3,000,000
- Pa. Bristol—Patterson Parchment Paper Co., Bristol, plans to construct a factory and office building. Estimated cost will exceed \$48,000
- Pn., Conshohocken—Lee Rubber & Tire Corp., Conshohocken, plans to construct an addition to its Spring Mill Plant. Estimated cost \$100.000
- Tex. Freeport—Dow Chemical Ca. Freeport, plans to construct a glycol plant to cost \$5,000,000; vinylidene plant, \$6,000,000; vinyl plant, \$5,000,000; styrehe plant, \$3,500,000, and power plant \$720,000
- Tex., Marshall—Texas-Illinois Natural Gas Pipe Line Co., 20 North Wacker Dr., Chicago. Ill., plans to construct a pipe line boorter station and a pipe line remintenance warehouse at Darco about 8 rd. south of Marshall. Estimated coat \$800,000 and \$255,000 respectively.
- Utah, Salt Lake City-The Filtrol Corp., 634 South Spring St. Los Angeles, Calff., plans to construct a manufacturing plant. Estimated cost \$2,560,000
- Wash. Scattle-California Ink Co., 2627 Western Avo., plans to construct a 1 story ink manufacturing plant. Estimated cost \$68,800
- Ont., Niagara Falls—Canadian Cellucotton Froducts Co., Ltd., 421 Victoria St., pians to construct a 4 story factory. Estimated cost \$1,250,000
- Ont. Rodney-Great Lakes Paint Co., William C. Curtis, Mgr., plans to construct a 2 story factory. Estimated cost \$100,000

	Current I	Yajecta		tive 1960
	Proposed Work	Contracts	Proposed Work	Contracts
New England Middle Atlantic South Middle West Wort of Mississippi Far Work Canada	208,000 450,000 1,543,000 28,400,000 2,718,000	\$9,475,000 0,166,000 2,983,000 10,890,000 20,100,000 1,300,000	\$2,068,000 1,010,000 56,768,000 10,909,000 104,255,000 23,954,000 19,656,000	8472,000 22,743,000 37,487,000 20,914,000 47,969,000 4,359,000 23,067,000
Total	834,507,000	\$51,906,000	\$218,710,000	\$157,011,000

Contracts Awarded

- Ala., Birmingham—Barrett Div. of Allied Chemical & Dye Cerp., e/o contractor, has awarded the contract for a warehouse (first unit of manufacturing plant) to Brice Building Co., 136 South 13th St. Estimated cost \$48,000
- Calif., Los Angeles—Procter & Gamble Co., 1151 South Bway, will alter its warshouse at 1691 West 7th St. Work will be done by owners. Estimated cost \$100,003
- Del., Newark.—National Vulcanized Fibre Co., Newark, has awarded the contract for a 1 etory, 60x520 ft. factory te William N. Worrall, 220 South Union St., Kennett Sq., Pa. Butimated cost \$150,000
- III., Chicago—Packit Envelope & Bag Co., 4040 West Orden St., has awarded the contract for a factory to contain 45,000 sq. ft. space to Campbell, Lowris, Lauthermlich, 400 West Madison St. Estimated cost \$250,000
- III., Skokie—G. D. Searle & Co., Skokie, has awarded the contract for a pharmaceutical plant and laboratory to George A. Fuller Co., 111 West Washington 8t, Chleago. Estimated cost \$759,009
- Idaho, Arco—Atomic Energy Commission, 1991 Constitution Ave. N. W., Washington, D. C., has awarded the contract for a reactor testing station to Fluor Corp., 2509 Atlantic Blvd. Los Angeles, Calif. Estimated cost \$20,000,000
- La., New Orleans—Radal Southern Corp., c/o George L. Dahl, Architecta & Engineers, Archite, 191 North St. Paul St., Dailas, Tex., has awarded the contract for a warehouse and office for U. S. Rubber Co., to Perrilliat-Rickey Construction Co., P. O. Box 7627, Extimated cost \$106,006
- O., Avon Lake—B. F. Goodrich Chemical Co., Rose Bidg., Cleveland, has awarded the contract for a sales and service laboratory building to H. G. Slatmeyer & Son Construction Co., 282 Lakeside Ave., Cleveland. Estimated cost \$500,000
- O., Mt. Vernon--Pittsburgh Plate Glass Co., Grant Bldg., Pittsburgh, Pa., has awarded the contract for a 2 and 2 story plant, warehouse and office to Austin Co., 16112 Fucild Ave., Cloveland. Estimated cost \$2,000,000
- O., St. Bernard—Emery Industries, June and Long Sta, has awarded the contract for a 1 story factory to Dawson Evans, St. Bernard. Estimated cost \$180,000
- Pa. Bradford—Kendail Refining Co. Bradford, will construct a platforming refining plant. Work will be done under supervision of Universal Oil Products Co., 318 South Michigan Ave., Chicago, Ill., Engre. Estimated cost including equipment 18,000,000
- Pa., Bristol—Rohm & Haas Co., Washington Sq., Philadelphia, has awarded the contract for a laboratory and office building to Frank V. Warren, Inc., 925 West Thompson St., Philadelphia, Estimated cost \$250,000
- Pa., Pittsburgh.—Penn Oll & Lubricating Co. 4 Kingsiand Dr., has awarded the contract for two warehouses to B. Dinatic, 6664 Apple Ave. Estimated cost \$75,000

- Pa., Rouseville—The Pennsoli Co., Oll City, has awarded the contract for enlarging its eil redinery to included a propane-deresining, realins and tractioning unit, to M. W. Kellong Co., 225 Bway, New York, N. T. Entimated cost including equipment \$1,800,000
- Tex. Dallas—General Portland Coment Co. Republic Bank Bldg., will construct a cement plant unit. Work will be done by owners with subcontracts. Estimated cost \$50,000
- Tex., Freeport—Dow Chemical Co., Freeport, has awarded the contract? "Crit 2 of ethylene glycol paan to Austin Co., M & M Bidg., Houston, estimated cost, \$4,000,000; Unit 4 in light hydrocarbon plant to J. F. Fritchard & Co., Gulf Bidg., Houston, estimated cost, Tellopson Construction Co., 1710 Telephone Rd., Houston, estimated cost \$2,750,000. Estimated grand total \$9,750,000.
- Tex., McKee...Shamrock Oil & Gas Corp., McKee, will reconstruct treater unit of gasoline refinery. Work will be done by owners. Entimated cost \$90,000
- Tex. Orla—Pecos Petroleum Ca. Pecos, will construct a gasoline plant absorption usit to have a daily capacity of 26,406 gal. Work will be done by owners. Butmated coat \$425,00
- Tex. Waxahachie—Southland Cotton Oil Mill, Waxahachie, will construct a cotton oil mill plant. Work will be done by owners. Estimated cost \$125,000
- Va., Roanoke—Lone Star Portland Cement Co., 342 Madison Ave., New York, N. Y., has awarded the contract for a cement plant near here to Waish Construction Co., 1 East 43rd St., New York City, and Raiph E. Mills Co., Inc., 1310 Tennessee St., Salem; silos and packhouse to MacDonald Engineering Co., 158 West Randolph St., Chicago, Ill. Estimated cost \$6,000,000
- Wis., Milwaukee-Pittsburgh Plate Glass Co., 235 East Pittsburgh Ave., has awarded the contract for a warehouse and office to Ray J. Mothe Co. Inc., 2901 West Rohe Ave. Estimated cost \$203,000
- Ont. New Toronto—Goodyear Tire & Rubber Co. of Canads, Ltd. Lake Shore Rd. has awarded the contract for a 40x240 ft. plant addition and a 2 story, 4x25 ft. power plant addition to The Carter Construction Cn. Ltd. 419 Cherry St., Toronto. Estimated cost \$1,00.000
- Que., Montreal East.—Canadian Oil Companies, Lid., 394 Richmond Ht., Toronto, Ont., has awarded the contract for a lubricating and grease plant on Notre Dame St., to Fluor Corp. of Canada, Ltd., 1175 Sherbrooke Ht., Montreal, Betimated cost \$300,000
- Que., Montreal—Rosenbloom Paper Supply Co., Inc., 6744 Rutchinson St., has awarded the contract for a 1 story, 120x126 ft. factory addition to Ain & Zakata, Ltd., 6910 Wiseman Ave., Quiremont. Entimated cost \$90,000

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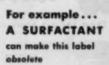
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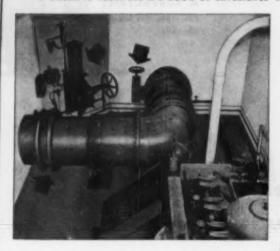
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No. 700—20-inch 30-pound Cast Iron Vatvo with rubber seat, Type 8-8934, for positive 100% shutoff. Heavy duty handwheel control with threaded reach rod. Type 8-9469.



No. 724—42-inch 50-pound Heavy Service Valve, B-9813, complete with limiterque moter and gear reduction drive No. 4. Angular seating vane for wedge-type closure with matein seat. Rubber soat available if desired. Valve body good for 125 pair gouge stolc head and drip tight shut-off at 50 psi pressure drop with rubber seat.



Na. 768—66-inch Fabricated Steel Mandwheel Operated Valve with ends creffled for welding. 6/5-inch diameter ene piece Steinless Steel shaft mounted on Mrust bearings (valve installed with shaft vertical). Herizontal and vertical ribs on body prevent distortion when machining and assembling. Staffing box easily repacked. Used to central river how during dam construction. Open otmespheric discharge.



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The Clean-Out Manometer (at left) for line pressures up to 100 lbs. per sq. in. A wing nut permits the Manometer body and tube to be disconnected from the head — the tube cleaned with a brush furnished or tube replaced, and the instrument reassembled without disconnecting the head section from the piping. Send for Bulletin No. 1.

The Model A-995 WM Manumeter for line pressures up to 400 lbs. per aq. in. These instruments are built with heavy walled annealed straight Pyrex tubes, gland packed top and bortom in steel end blocks and clamped to the body at fixed intervals to prevent distortion. Catalog Sheet A-995 WM gives complete details.



Model A-275 WM (at left) is a direct reading type for line pressures up to 150 lbs. per sq. in. Standard construction; ranges — from 6" to 24". Wall mounted type shows; also available in flush mounting. Ask for Catalog Sheet A-275 WM.

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This Sight Feed Bubbler with 2\%" dis. bowl of Pyrex glass is good for line pressures up to 50 lbs. per sq. in.; of plastic, for pressures up to 100 lbs. Sturdily built with brass or semi-steel body. Supplied in ring type (shown) and strap type. Needle valve controls bubbler rate. Ask for Bulletin 21.

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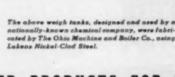
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CHEMICAL ENGINEERING-July 1950



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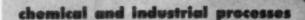
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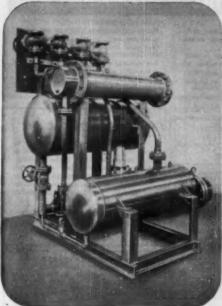
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Save time-save installation difficulties-get immediate operation and use. A Blaw-Knox compact, self-contained Dowthern heating and cooling unit comes to you in one package ready to connect to water and power supplies without further assembling. Installation is quick-simple -inexpensive.

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Sin Wort 43nd St., New York 18, N. Y.



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Make it a HABIT . . . to check this page -EACH ISSUE

This WHERE TO BUY Section supplements other advertising in this issue with these additional canouncements of products and services essential to efficient and economical operation in the process industries.

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The advertising rate is \$10.00 per lack for all advertising appearing on other than a con-AM ADVERTISING INCH is measured 7/8 inch vertically on one column, 3 columns 30 inches-te e page.

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WANTED FOR CHEMICAL PLANT LOCATED IN SOUTH

ESTIMATORS

Must be experienced engineers, under 40, familiar with Refinery and Chemical Plant design and capable of estimating process equipment installations from flow diagrams and specifications. Give full information, experience record and salary expected.

DRAFTSMEN-DESIGNERS

Preferably with ME, CE, or EE degree. under 40, with at least three years drafting experience in Chemical or Oil Industry. Give full information, experience record and salary expected.

P-6846, Chemical Engineering 520 N. Michigan Ave., Chicago 11, Ill.

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Excellent opportunity for Research

Chemist with good technical background and experience in shoe and

leather chemicals, especially shoe fin-

ishes. Desirable locality with reliable

concern. Reply stating full experience and qualifications. All information will be held in strictest confidence.

P-6736, Chemical Engineering 220 W. 42nd St., New York 16, N. T.

REPLIES (Bog Ho.): Address to office nearest you NEW YORK: 880 W. \$9nd St. (18) CHICAGO: 880 R. Michigan Ave. (12) SAN PRANCISCO: 62 Post St. (4)

POSITION VACANT

ENGINEER 25 to 30 years for training in re-search and product application for proserva-tion of equipment in the public utility and ma-rine field. Applicant should be capable of independent research for meeting design, plant operation and research heads, and of preparing and delivering papers to technical groups. Travel, with headquartors in New York. P-4856, Chemical Engineering.

SELLING OPPORTUNITY OFFERED

SALES ENGINEER: To Represent on commis-sten basis Manufacturer of Heat Transfer Equipment in Middle west and South Atlantic States. RW-6832, Chemical Engineering.

EMPLOYMENT SERVICES

SALARIED POSITIONS 83,500-355,606. If you are considering a new connection communicate with the undersigned. We offer the original personal employment service (68 years recognized standing and reputation). The procedure of highest othical chandards is indicated to the contract of the c

SALARIED PERSONNEL, \$2,600-\$25,000. This confidential service established 1927, is greared to needs of high grade men who seek a change of connection under conditions assuring, if employed, full protection to present position, feed name and address only for details. Personal consultation invited. Jira Thayer Jennings, Dopt. B. 341 Orange St., New Haven, Cunn.

CHEMICAL AND Sanitary Engra: University Instructors to Dept. Heads at \$8006. Nation Wide coverage. Give Phone, Photo, Cualif. Cline Teachers Agency, East Lansing, Mich.

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CHEMICAL ENGINEER: M.S., age 29. new employed. Six years process development, patents, honora Beek new position in chemical or feed industry. West Coast preferred, consider others, PW-709, Chemical Engineering.

CHEMIST-M.S.—10 yrs. experience laboratory apparatus manufacturing. Creative and good openion. Decireo responsible position. PW-7134, Chemical Engineering.

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Graduate mechanical or electrical engineer to do development and application engineering in the instrument field primarily on temperature detectors. Several years' development experience in the in-strument or allied field desirable. Write giving full particulars.

LEEDS & NORTHRUP CO.

4901 STENTON AVENUE PHILADELPHIA 44 PA.

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ADDITIONAL PRODUCTS desired by technical, aggressive sales representative currently contacting Chemical, Food and Industrial Plants in Midwest. BA-6941, Chemical Engi-

CHEMICAL ENGINEER — young, ambitious and aggressive wishes to offer technical representation and service in the Midwest to reputable chemical and equipment houses in basic chemical, metals and allied lines. Agency basis preferred. RA-7018, Chemical Engineering.

SALES REPRESENTATIVE. Metallurgist, co-tablished in Chicago for II years, wants addi-tablished in Chicago for II years, wants addi-leading chemical, pharmaceutical, feed and beverage industries. Stainless steel specialist. RA-7119. Chemical Engineering.

ENGINEER

. . . for development engineering on industrial process instruments used in the chemical industry. Prefer applicant with degree in chemical engineering and several years' experience in the chemical field. Knowledge of electronics and physics desirable. Write giving full posticulars. full particulars.

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EDIBLE OIL EXTRACTION

WANTED: Sales Group or Fabricator to promote sale Hildsbrundt Type Extraction Equipment. Conculting or employment basis. Complete design. Patent protection

BW-7014, Chemical Engineering 330 W. 42nd St., New York 18, N. T.

POSITION AVAILABLE

Civil Engineering graduals with minimum 12 years' coportence to opportion project segments on building work waste disposal and structural design. Schwidzing cingerione one decirate. Lustien in East with cataloisand consum. Furnish detailed resource of sparrices and education, size sales? The Judick, Chemical Engineering 200 W. 43nd St., New York 18, N. Y.

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High standing. Research, development and general observations on booking the standing of the standing and magnitude place if available of the standing of the standing and magnitude place if available of the standing of the

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CHEMICAL and METALLURGICAL
Investigate our active confidential service for the hotter position. Appointments
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Engineers - Executives - Technical Men Salaried Publices, 54,896 to 309,600. Tole Con-fidential service for test who desire a new consec-tion, will devote and conduct previousney negotia-tions without risk to present position. Send name and address for design.

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OPPORTUNITIES

Whatever your need— think "SEARCHLIGHT" FIRST

TEXAS

Professional Engineer Graduate and Post Graduate V. P. I., and M. I. T., with 35 years varied experience in the Chemical Industry interested in opening engineering office in Houston to undertake commissions for individual or firms having business interests there and to represent equipment munufacturers.

RA-7967, Chemical Engineering 130 W. 43nd St., New York 18, N. Y.

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U. S. trained, experienced Chem Engr. (D.Ch.E.) shortly returning to India is interested in representing American Memo-facturers of equipment, chemicals and instruments.

RA-7687, Chemical Engineering 220 W. 42nd St., New York 18, N. Y

INDUSTRIAL PLANTS FOR SALE

Taunton, Mass. 180,000 sq. ft.

Yankton, So. Dak. 25,000 sq. ft.

With adequate land for expansion. RR sidings immediately alongside plants. Both reconstructed and re-equipped 1943 for producing industrial or beverage alcohol (at Yankton, from local grain). Also suitable for rapid conversion for chemicals, pharmaceuticals, paints, detergents, corn or soy products, livestock premium supplemental feeds, tanning, bleaching, dyeing, plastics or processes using distillation, pressurized steam conversion, tankage and large steam producing equipment.
Unusually favorable cooling water facilities. Samuel S. Warner, Room 612, Empire State Bldg., New York, New York, or your own broker.

Opportunity.. the position . you want in industry!

Our hackground of personalized service and proven methods points the way to jub satisfaction for you. This is not an employment egency but a company specializing in showing you exactly how to "sell yourself" to the pro-

Send \$5.00 for questionaire. After you give us necessary information, we will furnish you n portlaio containing on attractive and cor ractly prepared recurse of yourself, a latter to send to prospective employers and a co n of tested methods of selling yourself. After a large examined this, we will bill you 0.00, making a total cost (no extract of only \$15.00 for the complete, unfueble se

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CUSTOM REFINING FACILITIES .

- Distillation Separations
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- · All Types of Crude Mixtures · By-Products, Residues, Wastes
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Complete Allis Chalmers solvent extra tion pilot plant using Hoxano as 6 solvent and including solvent recovery equipment. Capacity 308-400 lbs. se beens per hour. Used very little-thre waters old.

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Do you have a capital goods type product that can be sold to the petroloum and chemical industries but lack .

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A nationally known and long estab-lished manufacturer in the capital goods field is interested in purchasing a pred-uct or products that will complement its

The product must have its major sales potential in the petroleum and chemical industries, be adaptable to present manufacturing facilities.

If you are the owner of such a product and are contemplating its sale because of manufacturing or marketing difficulties, please write.

All replies will be treated with the

BO-6854, Chemical Engineering W. 42nd St., New York 18, N. T.

ASH PAID CHEMICAL PLANT

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By large finance diversified organ diversified organization ing to add another prise to precent holding

Bex 1221 1474 B'woy N. Y. 18, N. Y.

DRYER FOR SALE EXTRAORDINARY BARGAIN

One Link Sair Nulti-Louvre Dryer 281 in Actual operation less than one rous Perioc condition. New dissemuled in de storage. Freeen markel value appres 18,00,00. Will secrifice for 8,000. F.O.B. cars Pittsburgh. Speed 68 F.P. Ari Henter 900,000 BTU/hr; Cyclone Collector; Exhauster 1719 CFM; Gan Mines Combustion Blower; Controls Motors on

CALGON, Inc.
323 Fourth Avenue Pittsburgh, Page

WANTED -- SOLVENT

Westes of All Kinds
REDISTIL OR PURCHASE
Also Surpluc Chemicals, Dyes, Pigmente.
Oils, stc., By-Products, Residues, Equipment
CHEMICAL SERVICE CORP.
80-84 Beaver St. New York 3, N. Y.

Compressors Wanted

STATIONARY - PORTABLE L. W. BAUER Bloomfield, N. J.

WANTED 12,000 GALLON TOTALLY ENCLOSED TANK Rubber or Rosin Lined or Stainless Ste Vertical type preferred.

SYNVAR CORPORATION WILMINGTON, DELAWARE

FOR SALE PREFORM MACHINES

2 Stokes Model DDS-4 Reeves Drives and Motors Colton Model 51/2 T.M.D. Stokes Model T.M.D. Stokes DDS-2 M.D.

FS-7006, Chemical Engineering \$30 W. 42nd St., New York 18, N. Y.

WANTED

One Constant Weight Feeder To handle dry material at rate of 100 to 5,000 pounds per. Please give full information as to condition, location, price etc.

W-6006, Chemical Engineering 520 N. Michigan Ave., Chicago 11, Ill.

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Consisting of: REAL ESTATE, EQUIPMENT, INVENTORIES, SUPPLIES

All equipment in place as operated and a greater part of machinery in this plant was installed new within the past 4 years. Your prompt action will save you time and money. Act now.

Listing of small portion of major items. Send for details.

- 4-HYDRAULIC PRESS MANUFACTURING CO. 75 ton
- STEEPING PRESSES complete with pumps.

 SWENSON 6% antimony load single effect EVAPORATOR with horiz. Europte tubes. 260 sq. ft. heating surface.
- S CERINI Coustic Sode DIALYZERS.
 1-FULLY AUTOMATIC CAUSTIC SODA MAKE-UP AND MIXING SYSTEM with rotameters, recorders, heat an-
- changers, pumps, tanks, etc.
 -TOLHURSY 40" Centre slung copper basket CENTRIFU-
- I.—TOLHURST 12" copper basket. Self balancing, direct Motor drives, LABORATORY CENTRIFUGAL. 1.—16 SPINDLE BUTTERWORTH SAMPLE POT SPINNING
- MACHINE.
- 150 TON AMMONIA REFRIGERATION UNITS each directly connected to 250 HP Synchronous motor, com-plete with brine pumps and condensing equipment.
- GENERAL ELECTRIC CO. 800 EVA Synchronous motor GENERATOR SET or FREQUENCY CHANGER, complete
- with control panel. (Unit new in 1948).

 GENERAL ELECTRIC 180 EW Synchronous MOTOR
 GENERATOR SETS or FREQUENCY CHANGERS.

REAL ESTATE 3 Story Building Total 250,000 sq. ft. 468' long x 91' wide 3 Otis Freight Elevators

Send for complete detail information.

- 26—5" dia. x 11" long. %" horizontal STEEL STORAGE TANKS, 1606 gal, capacity with manholes, sight glasses.
- 4-STEEL JACKETED TANES, Closed Top. Cone Bottom. 8'6" dia. x 6' deep x %"-1750 gallon capacity
- 1-SHARPLES LABORATORY SUPER CENTRIFUGE
- I-ECONOMY MOTOR DRIVEN BALER
- 2—TUNNEL DRYERS, automatic temperature control, one 190' long, one 40' long. Complete with trucks and all
- 4—BAKER PERKINS under-driven jucksted DISSOLVERS OR MIXERS. 358 gallons capacity each.
- 1-PATTERSON FOUNDRY & MACHINE CO. jacketed overdriven 650 gallon MIXER.
- 2-HEAT EXCHANGERS built entirely of 316 Stainless Steel. 450 sq. feet surface each.

Representative at premises to serve you.



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Large Stock at Brook!

6-Anderson No. 1.0H Exesters.

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STEIN EQUIPMENT COMPANY

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LOWER PRICES NOW ON GOOD USED AND NEW PROCESSING EQUIPMENT

Day Stainless 40 Gal. 2 Speed Peny Mixer, 5 HP--New Hardings Ball Mill, 6' x 22" 3 Bird S.S. Filters, 18" x 28" Boflovak 5' n 12' Chromod Single Drum Var. Drysr-33 11P Practic Extruders; No. 1/2 to 4 Injection Modding Machines 1 to 10 or. Preformers, single and retary, all makes 6.8. Reactor 120 Gat. Jktd. Agitated Buffevali Astociavo, 4' a My', 1000 ff Proc. Sanisary Mixer 53, 100 HP, also No. 00 90" Colondar with Borod Rolls Bay Double Arm 40 gal. Jktd. Mixor with sigma stades & W&F 100 Gat. Bimpson Intensive Misers 211/2 and 2 Louisville Steam Tube Dryers, 6' x 50'

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VACUUM DRYERS

- Retary Vacuum Dryers: 5' x 33' and 5' x 25' Devine; 4 x 20' #59-C Stokes: 3 x 15' #59-B Stokes; auch complete with
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 -Vacuum Shelf Dryers: #4-C Devine with 9-40" x 43" shelves; -Yocuum Shelt Dryers: 24-C Devise with 7—40" x 43" shelves; 211 Devine, 17—40 x 43" shelves; Devine with 18—59" x 78" shelves; Devine #23 with 13—59 x 78" shelves; 29—40 x 43" extra welded vacuum dryer shelves.

 -Yocuum Drum Dryer, double rolls, each 42" dio. x 120", complete, mode by Buffelo F. & M. Co.—Also 5' x 10'6" Devine
- with single bronze drum.
- 1-6' x 60' LOUISVILLE ROTARY STEAM TUBE DRYER, with unused and welded Steel shall and tubes. 27—414" and 27—3" tubes.

 5'4" x 49" RUGGLES COLES STAINLESS STEEL ROTARY DRYERS, for direct
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- 3—36" x 36" Shriver Rubber Filter Presses, semi-hard 1½" rubber plates, rubber covered 3" cast iron frames; 4-aye, corner feed, closed delivery, washing type. Each 18 chambers. Each with 50-ton Seco closing device.
- 1-30" x 30" ALUMINUM PLATE AND FRAME FILTER PRESSES. Sperry-43
- Chambers, side feed, open delivery, used on pectin. In excellent condition.

 8' x 15' Oliver Precort Filter.

 12 SWEETLAND FILTERS, 36 leaves on 4", also 72 on 2".

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 830 gal. closed, Jack., agis. STEEL KETTLES, 10 H.P. Motors & drives.
- VACUUM SHELF DRYER. 17 abelvas. 40" x 43". 300 qul. PATTERSON HIGH CHROME MANGANESE BALL MILL... 54" x 54".
- jacketed, with drive and motor.

 -J. H. Day ALUMINUM Horis, 1.000# DRY POWDER MIXER,
 -8' x 12' OLIVER ACID-PROOF FILTER, lead fitted.
- SIMPSON INTENSIVE MIXERS-#2, 8' dia.; #11/2, 4' 6" dia.
- 1—2.000 gel. STEEL KETTLE, jack. open top. cgit., 7' x 7'6''.
 2—BAKER PERKINS MIXERS, size 17. Jacketed, 200 gallon.
 1—ROTARY VACUUM DRYER, 3' x 33'.
 1—6' x 12' ALLIS CHALMENS ROD MILL.

Baker Perkins heavy duty dispersion mixer-stainless steel, 100 gal. working capacity hydraulic tilt, suitable for vacuum, with drive and 60 HP motor, complete.



15 Park Row, New York 7, N. Y.

BArclay 7-0600

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Furthermore you buy from a reputable dealer with the assurance that whatever representations he makes will be lived up to, because he wants your business again. "Caveat Emptor" (let the buyer beware) is as obsolete as last week's newspaper, so far as our customers are concerned. So, when you want good Used Machinery, see us and BE SURE.

We Want to Buy Your Idle Machinery from Single Items to Complete Plants

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When you "BUY BRILL" you buy equipment reconditioned by BRILL in THEIR OWN SHOP and under THEIR OWN SUPERVISION where only the HIGHEST STANDARD is accepted.

FILTERS

Succeived \$12, with his bases, 4" contern, facceived \$712, with 10 hears.

Succeived \$12, with 10 hears.

Succeived \$12, with 10 hears.

\$12, with 10 hears.

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\$13, with 10 hears.

\$13, with 10 hears.

\$14, with 10 hears.

\$14, with 10 hears.

\$15, with 10 hears. to 42".

SCREENS

6-Retax Screens, 20"x48", 40"x50", 40"x120", Single and Double Derk, 6-Tyler Hummer 4"x18", 4"x5",

KETTLES-EVAPORATORS

Other 2000 cm. others jacketed, agitated, detect 200 pm. seven jacketed, agitated, detect 200 pm. seven jacketed, agitated, ag

stainless toils.
Sufforables of dia, Cryotaltipers,
2's15' lackoted Cryotaltiper,
Capper Vas, Sillie 7s to 100 pai,

PULVERIZERS AND MILLS

Raymend 4-roll and 3-roll High Bide Mills with isoprators, cyclings, dust cellbetors, ob. Abba 19 kif providence, dust cellbetors, ob. Abba 19 kif providence, dust cellbetors, ob. Abba 19 kif providence, dust cellbetors, dust c

MIXERS-ALL TYPES

Sanbury 500 Mixer with 10HP motor & forced feed fubrication.

-Exist Perkins 100, 50, 20 and 5 gain., Josheted Double Arm.

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(50 cd.).
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DRYERS-KILNS

Rose Eng. 2-Truck Almospheric Dryers, steam-houled, 500 op. 11. Grying surface: has single units or mellipse. Surfaces 4'19', 32'100', 33'172', 36'160' Almospheric Deskib Drom. Surfaces 3'112', 3'14', 4'19', 4'18' Mogdo Drum Dryers.

6—ARIc Chalmers Retary Kilns 9'6"x230', 7'6"s 125', 9'x87', 6'x80', 9'x80', 3'x80', -Mugales-Colon 6'x00 States, 3'x80', -Mugales-Colon 6'x00 States Retary Steam 4—Lenieville 9'x50', 6'x23', 6'x2', 38', 38'x20' Re-tary Steam Tube Orpore, 3-States, Outloo Retary Vas. Orpore, 16"x42', 3'r46', 9x28', 6'x80',

CENTRIFUGALS

ATAN 68 and 60 Suspended Type with chainess simil imperferate and perferred bands, button disabilities, etc.

Letter disabilities

MISCELLANEOUS

-Anderson Duo, FI Expellers,
-Mash, Hyter Varoum Pumps, to 360 cfm,
-Olivite sold-proof Contribusi Pumps, 21,5"x2". m.d. 5-Redgers, Stekes & Smith Powder Filters. 3-Knapp Automatic Can Labelers to #19 cans.

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KILNS, DRYERS, COOLERS - PER ABSORBER - HC1 Alberger, Karbate Con-struction, 16 ton/dap. (UNUSED).

AUTOCLAVE Jacketed, 0'28', S.S. clad. BOHLEB Dowtherm, 500,000 BTU, 125g pressure, Natl. Board, gas fired.

WEMCO CLASSIFIER-No. 73, Type SH entral classifler, 38 long, (UNUSED.) DRYERS Buflovalt, single drum, Vac-uum, 24"x20" S.S. drum, vari-drive

with pump. TRUCK DRYING OVEN, 6'8"x12'x12', complete. (UNUSED).

FILTERS S'x16' Oliver, continuous. S' x 6' Oliver cont., 88 Type 304. (WM-F & Convey (USECI).
Fal? Oliver, continuous, precoat.
F al? Gilver, continuous, precoat.
F dia, a l'face, Oliver, top feed, C.I.
F sq. ft. agitator.

17 goia.

PIFFE & FIFFINISH.—Ilaves, F' to 30°,

Karbate, 9° to 6°.

FUMPS.—Vacuum, Stokes, 21°C, 100 CFM.

Wilsey, 8°, 16° GFM @ 10° head.

La Bour, C.I., 100 GFM @ 10° head.

La Bour, C.I., 100 GFM @ 50° head.

Nach Hytor, Vacuum, etcs 18; (Unused)

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America finds a new, easy way to save

Our of the war has some one blessling—a lesson in thrift for millions of those who never before had learned to save.

Enrolled under the Payroll Savings Plan in thousands of factories, offices, and stores, over 27 million American wage earners were purchasing "E" Bonds alone at the rate of about 6 billion dollars worth a year by the time V-J Day arrived.

With War Bond Savings automatically deducted from their wages every week, thrift was "painless" to those wage earners. At the end of the war, many who never before had bank accounts could scarcely believe the savings they held.

The moral was plain to most. Here was a new, easy way to save: one a-well auited to the future as to the past. Result: Today, millions of American-are continuing to buy, through their Payroll Savinga Plan, not War Bonds, but their peacetime equivalent— U. S. Savinga Bonds.





From war to peace! War Bonds are now known as U. S. Savings Bonds, bring the same high return—985 for every \$15.75 at maturity.



Out of pay—into nest eggs! A wage carner can choose his own figure, have it deducted regularly from earnings under Payroll Savings Plan.



New homes to own! Thousands of new homes, like this, will be partially paid for through Bonds wisely accumulated during the next five to ten years.



Keeping cost of living in check! Buying only needed plentiful goods and saving the money which would bid up prices of scarce goods keeps your cost of living from rising. Bave automatically—regularly.

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\$ 3.75 6.25 7.60 9.38 12.80 15.60 19.75	\$193.00 225.00 290.90 487.76 489.00 790.00	93,143.45 3,607.54 4,229.03 5,414.97 7,317.30 6,660.43 10,638.74

Savings chart. Plan above shows how even modest weekly savings can grow into big figures. Moral: Join your Payroll Savings Plan next payday.

SAVE THE <u>EASY</u> WAY...

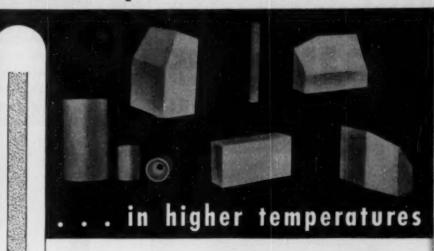
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THROUGH PAYROLL SAVINGS

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PURE OXIDE shapes work better . . .



In your own plant processes, you may be following today's trend to higher operating temperatures. And although higher temperatures are either speeding up old processes or producing new products, they are also increasing the demand for super duty refractories that will stand the gaff at high heat.

To meet these requirements, Norton Company is producing for industry a line of pure oxide refractories. These pure oxides, as the term implies, are made from raw materials which have been carefully selected as to source, composition, and high melting point.

Norton pure oxide refractories contain 99% plus of an oxide which may be fused alumina, magnesia, or stabilized zirconia. From these three materials, super duty refractories are regularly being produced in standard and special shapes (a few of which are illustrated above). Alumina and stabilized zirconia shapes can be made in dense form, having good thermal conductivity, or with open structure, in which condition they are excellent thermal insulators.

High purity alumina, magnesia, and stabilized zirconia are also available in the form of grain for use as a raw manufacturing material or for thermal insulation. Grains of both high and low thermal conductivity make it possible to control heat loss.

Further information on high temperature refractories will be supplied gladly upon your request. Much information may be obtained from our free bulletin POR-151. If you desire to correspond with us concerning the application of Norton pure oxide refractories to your plant processes, please address your correspondence to the Refractories Division.



HIGH PRESSURE PUMPS UP TO 30,000 PSI



- and motor driven up to 30,000 psi.
- -Up to 100,000 pei.
- HYDRAULIC PUMPS Hand-operated GAS BOOSTER PUMPS—Hand-operated and motor driven: up to 15,000 pal.
- HYDRAULIC PRESSURE INTENSIFIERS . HYDRAULIC PRESSURE GENERATORS -Up to 30,000 pai.
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REACTION VESSELS-Various types, with or without agitating mechanisms. Capacities from 43 ml, to 6 gal., for pressures up to 60,000 psi and temperatures up to 800° F.

FITTINGS & TUBING-Complete line including couplings, elbows, tees, crosses, adapters, gage connectors, electrical connectors. gas tank connectors. Tubing made of stainless steel and other alloys for pressures up to 100,000 psi.

INSTRUMENTS-Pressure and temperature indicators and controllers.

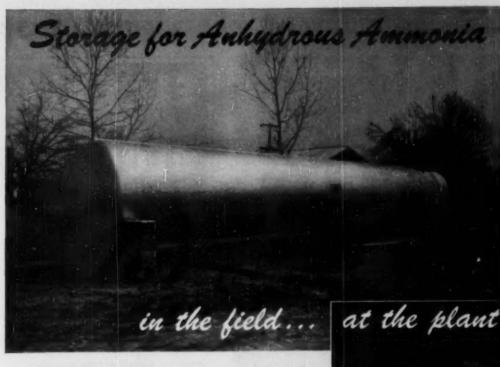
PILOT PLANTS-For many types of synthesis.

VALVES-Needle valves (straightway, angle and cross), also combined inlet and bleeder valves, for pressures up to 100,000 psi. Check valves for pressures up to 25,000 psi. Also others.

Write for Catalog 406 - D









Anhydrous ammonia storage, whether at the plant where the chemical is made, the dealer's bulk station, or in the farmer's tanks, has one important common characteristic. It takes pressure to properly store and handle this amazing fertilizer that is helping farmers reap an extremely abundant harvest.

At the dealer's bulk station, anhydrous ammonia is often stored in cylindrical pressure tanks. For reasons of safety, such tanks should be built by an experienced fabricator familiar with code requirements.

We built the 30,000-gal. tank shown above to ASME specifications for a working pressure of 250 lbs. per sq. in. It is located at the Ellendale, Tennessee, bulk plant of J. G. Appling & Son. The supply of ammonia stored in bulk tanks is transferred to truck or trailer tanks for farm deliveries. Delivery trucks are unloaded into farm tanks or directly into applicator tanks mounted on tractors.

Back at the producing plant, large capacity units generally provide the most economical storage. A Hortonsphere usually costs less per gallon of storage than several horizontal tanks. Furthermore, it requires less ground space and needs only one set of pipe connections and fittings. The 15,000 bbl. (630,000 gal.) Hortonsphere shown at the right is used to store anhydrous ammonia at a chemical plant in Louisiana.

In addition to pressure storage tanks, we also fabricate and erect flat-bottom storage tanks, elevated water tanks, and steel plate process equipment. Whenever you need storage tanks or steel plate structures, let our nearest office furnish estimates and quotations. at the plant

Cylindrical pressure tanks are widely used for storing highly volatile liquids and gases like propane, hydrogen, oxygen, etc. The Hortonsphere is usually installed to store butane, the more volatile grades of natural gasoline, or volatile refinery charging stocks. It has also been used to store isoprene, isobutylene, sulfur dioxide, and carbon monoxide.

Write our nearest office for more information about these pressure storage tanks.

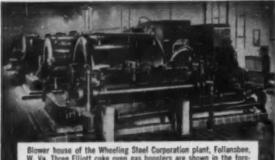
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Chemical recovery coke plants favor



Now The Windows of the Windows State Computation plant, Polasiasers, W. Va. Three Elliott coke oven gas boosters are shown in the foreground. Each booster is rated at 14,090 inlet cfm of saturated coke oven gas at plus 15 in. of water, compressing to 8 psig. The blowers are driven by Elliott turbines, the automatically controlled speed maintaining constant discharge pressure.

Blower room of the coke oven plant of Crucible Steel Company of America, Midland Works, showing three Eliott turbine-driven blowers. Two of these are exhausters and the third a booster. Each exhauster is rated 37,500 inlet cfm with an inlet pressure of minus 12 in, water and discharging at 3.5 psig. The booster is rated 25,000 inlet cfm, inlet pressure 8 m. of water, discharge pressure 5 psig.



THE ELLIOTT WELDED IMPELLERS

are possible because of improved welding technique developed by Efficit engineers. All blade junction points are smooth fillets, eliminating corners or crevices where las with riveted construction) dirt may collect and cause unbalance, loss of efficiency, and reduction in capacity; corrosive elements lodge and start attack; or erosion set in and destroy the blades.

ELLIOTT Centrifugal BLOWERS

In the modern coke plant, coke-oven gas, given off in the making of coke, is processed for the recovery of many valuable by-products such as tar, ammonium sulphate, pyridine, phenol, napthalene, light oil and finally fuel gas.

In moving the gas from oven to final process, Elliott centrifugal blowers are widely used, as both exhausters and boosters. This is a type of service for which Elliott blowers are particularly suitable because of the unique advantages in their welded impellers, free of corners or pockets in which tar and other viscous substances prevalent in the gas may lodge and cause unbalance.

The two modernized installations shown at the left are typical. In both cases, Elliott blowers replaced former reciprocating units.

Whatever you need for moving air or gases, check over Elliott blowers and the exceptional application experience behind them.





R-101

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SIMPLE COMPACT DESIGN The design is extremely simple, consisting of a metal ring which operates at a variable position on the two driving and two driven cones. The position of the ring on the cones determines the speed of the output shaft.

EXTREME FLEXIBILITY Speedrangers can be supplied for single phase, palyphase, or direct current operation. They can be furnished also with integrally built gear reduction units and electric brakes... in enclosed, splash proof fan-cooled or explosion proof construction and for a wide variety of mounting arrangements.

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Ten 3000 gallon etandard Pfaudler "R" Series glass-lined steel reactors for polymerization of synthetic resin at Fireston Plastics Co., Pottstown, Pa. Inset: Pfaudler Reactor showing glass-lining and glass covered impeller sgitator and patented

Standard

Pfaudler glass-lined reactors



solve Firestone's problem

PROBLEM: Processing vinyl and vinylidene chlorides at elevated temperatures and 125 psi. internal pressure with full vacuum; vigorous agitation during complete polymerization cycle.

SOLUTION: When the Firestone Tire & Rubber Co., Pottstown, Pa., approached Pfaudler with its problem, it was obvious that pressure, agitation, contamination and adherence of the product were serious factors. Pfaudler glass in combination with the Pfaudler Dual Rotary Agitator Seal with automatic counterbalance lubrication and seal cups for lower seal met these requirements.

Operating requirements were economically met with 10-3000 gallon standardized Pfaudler "R" Series glass-lined reactors. Equipped with standard three blade, glass covered impeller agitators and patented adjustable glass covered baffles, vigorous emulsification is obtained, converting a gaseous monomer to a resin polymer in the presence of a catalyst. Good yield is obtained. The end product is called "Velon."

Here is another example of thousands in Pfaudler files which illustrates how standardized Pfaudler equipment can often keep processing costs low. By specifying standards, you eliminate special engineering, take advantage of established performance, obtain faster delivery and lower costs through standardization and stock parts. Send for Catalog 860. Use form below.

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